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Toyoda et al.

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(45) **Date of Patent: Nov. 5, 2002**

(54) **PROGRAM FOR EXTERNALLY CONTROLLING A COMMUNICATION APPARATUS**

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(73) Assignee: **Canon Kabushiki Kaisha**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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Jan. 9, 1992 (JP) 4-2362

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(52) **U.S. Cl.** **358/468**; 358/434
(58) **Field of Search** 358/468, 442, 358/440, 400, 473, 434, 435, 438, 439; 379/100.01, 100.06

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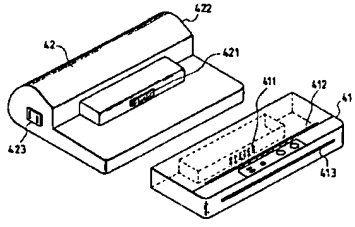
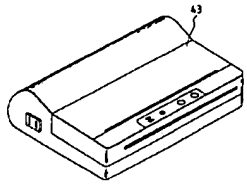
(74) *Attorney, Agent, or Firm*—Fitzpatrick, Cella, Harper & Scinto

(57) **ABSTRACT**

A program for externally controlling a communicating apparatus is provided. The program controls the communication apparatus externally by conducting mutual communication between the communication apparatus and an apparatus in which the program is executed, by means of a command and a response in reply to the command.

3 Claims, 41 Drawing Sheets





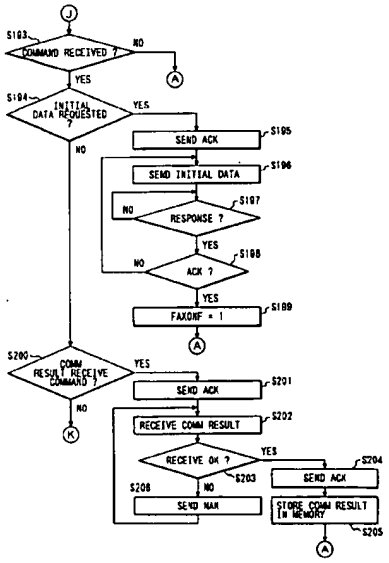


FIG. 1

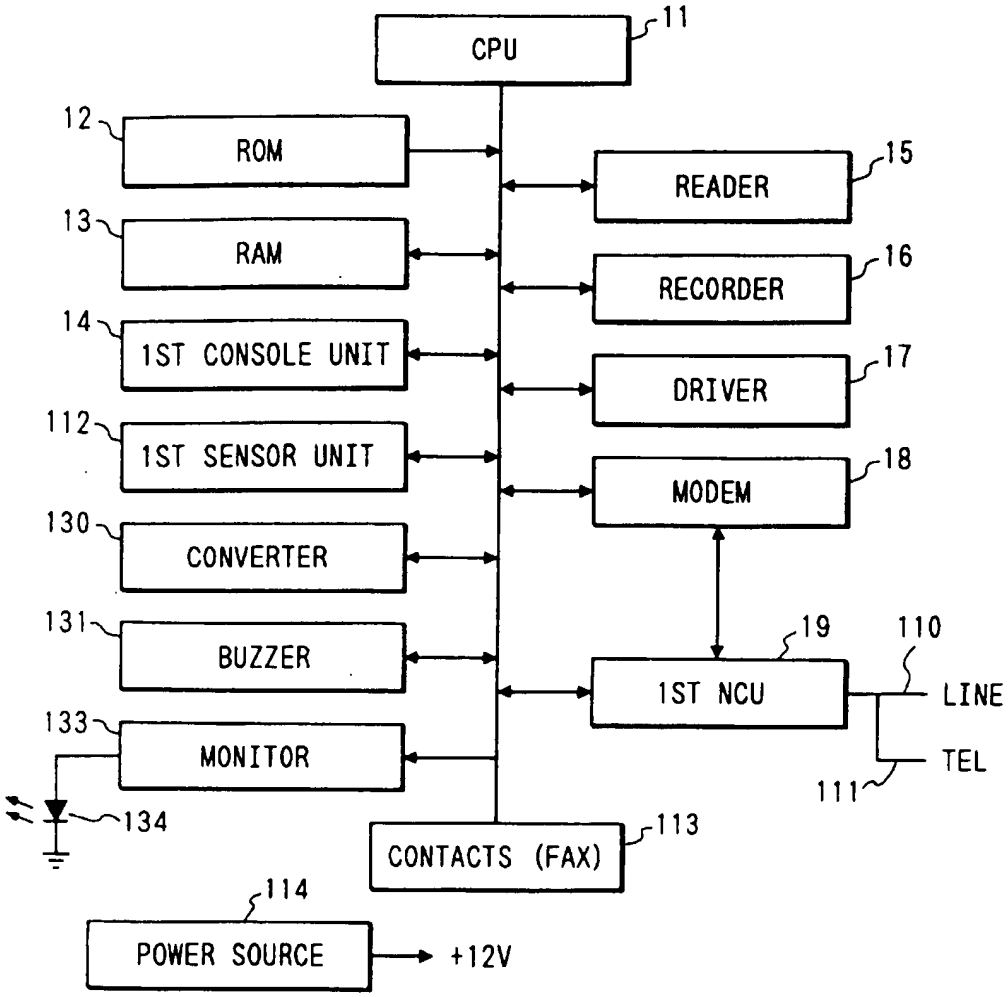

CPU
11
12
ROM
13
RAM
14
1ST CONSOLE UNIT
112
1ST SENSOR UNIT
130
CONVERTER
131
BUZZER
133
MONITOR
134
READER
15
RECORDER
16
DRIVER
17
MODEM
18
19
1ST NCU
110
LINE
TEL
111
CONTACTS (FAX)
113
114
POWER SOURCE
+12V

FIG. 2

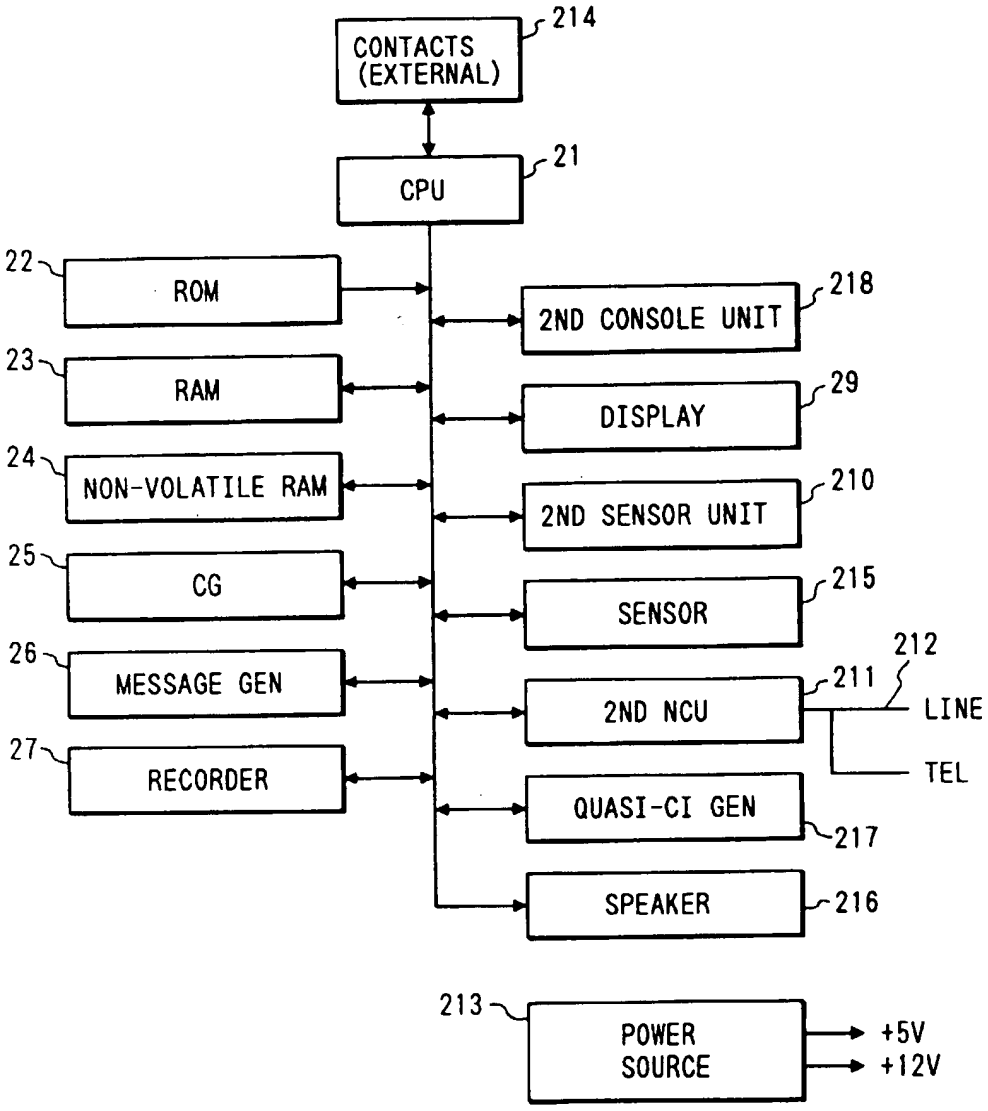

CONTACTS (EXTERNAL)
214
CPU
21
22
ROM
23
RAM
24
NON-VOLATILE RAM
25
CG
26
MESSAGE GEN
27
RECORDER
2ND CONSOLE UNIT
218
DISPLAY
29
2ND SENSOR UNIT
210
SENSOR
215
212
211
2ND NCU
LINE
TEL
QUASI-CI GEN
217
SPEAKER
216
213
POWER SOURCE
+5V
+12V

FIG. 3

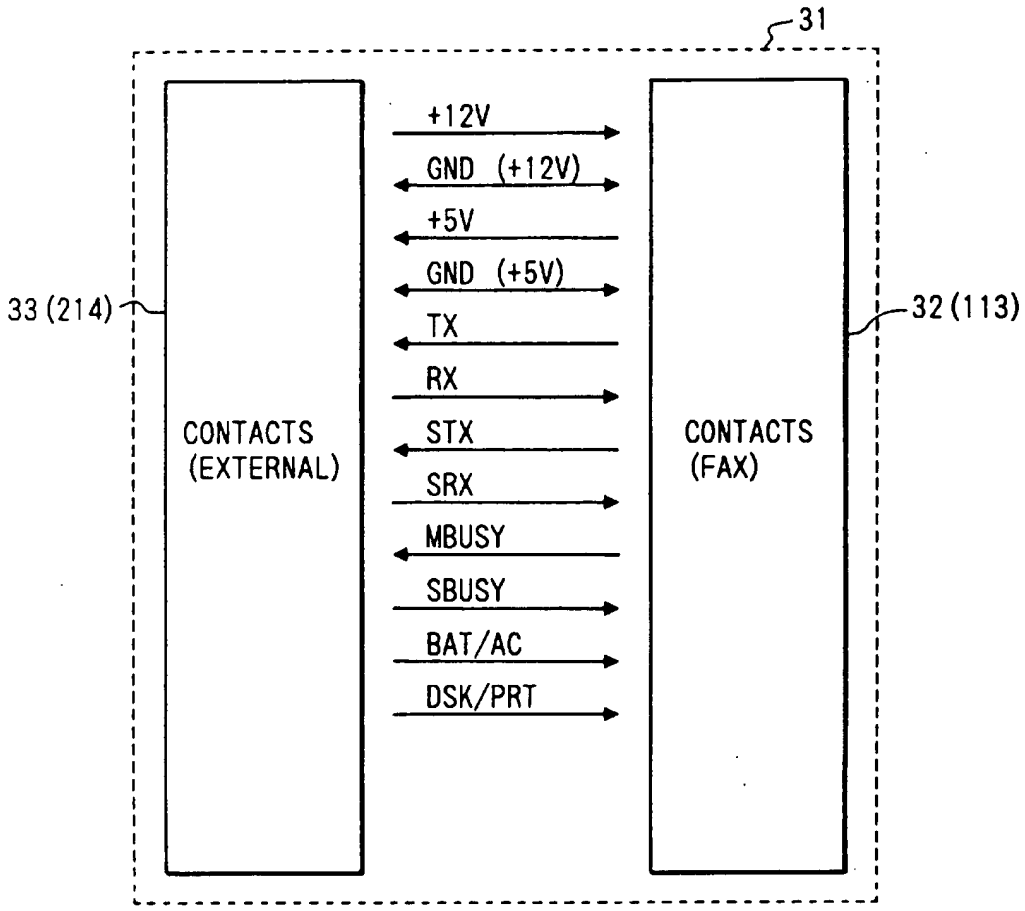

31
33 (214)
32 (113)
CONTACTS (EXTERNAL)
CONTACTS (FAX)
+12V
GND (+12V)
+5V
GND (+5V)
TX
RX
STX
SRX
MBUSY
SBUSY
BAT/AC
DSK/PRT

FIG. 4A

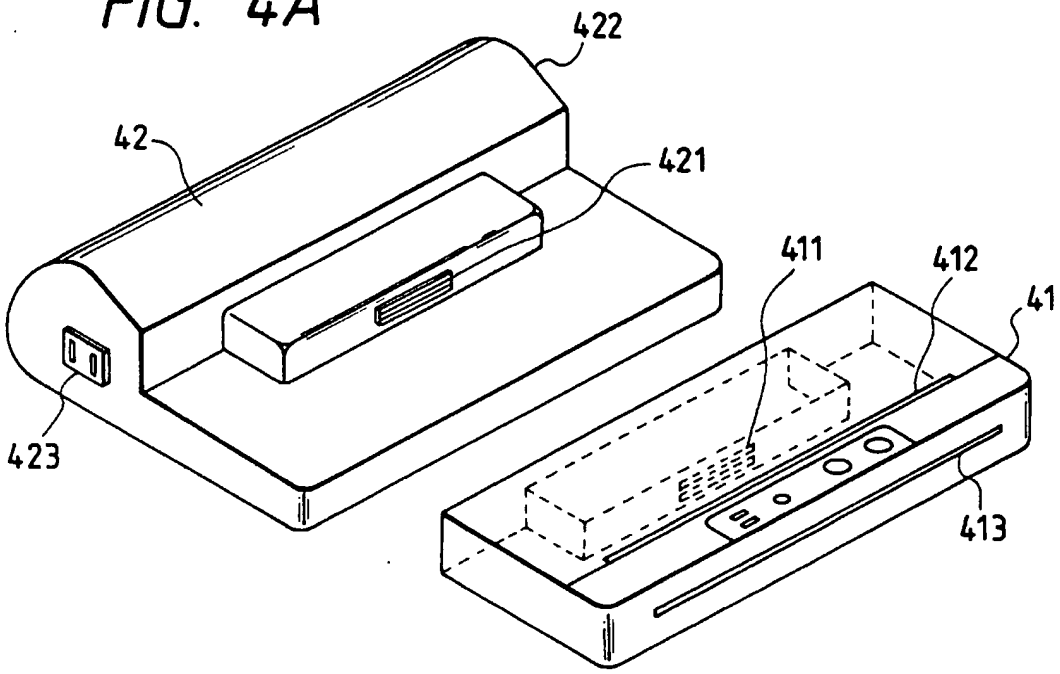


FIG. 4B

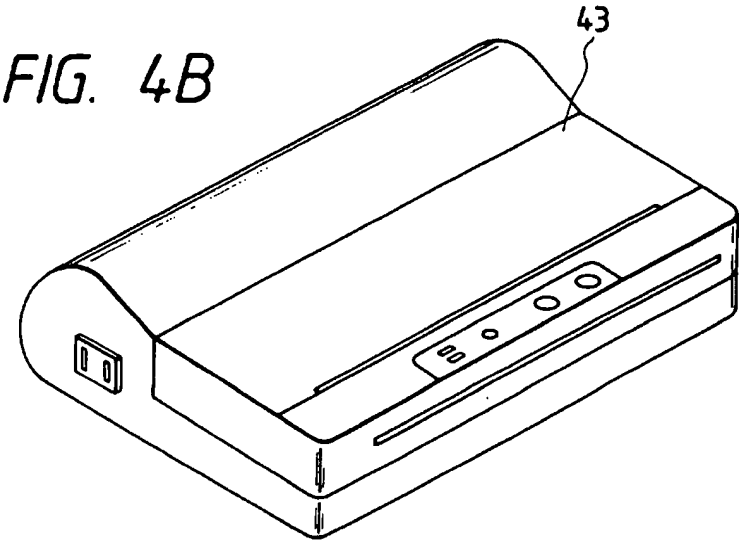


FIG. 5A

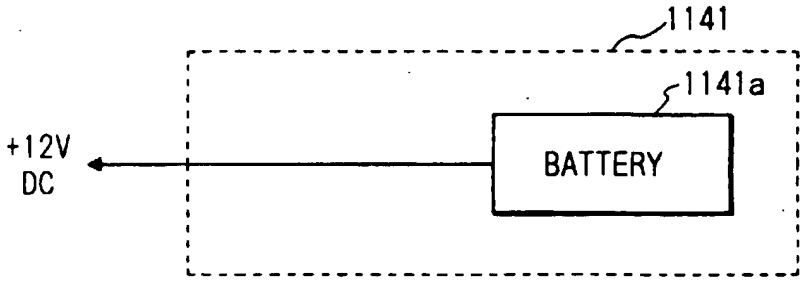


FIG. 5B

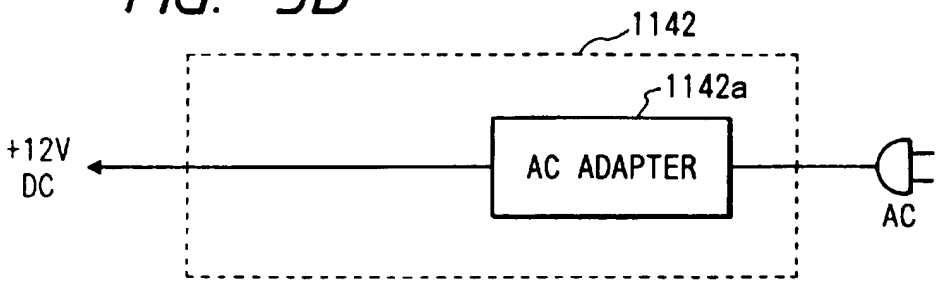


FIG. 5C

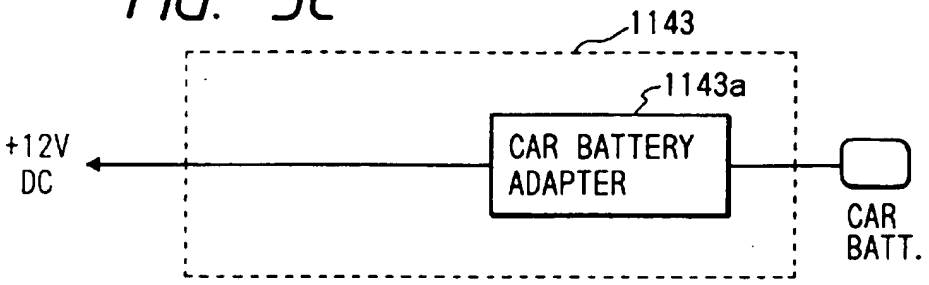


FIG. 6

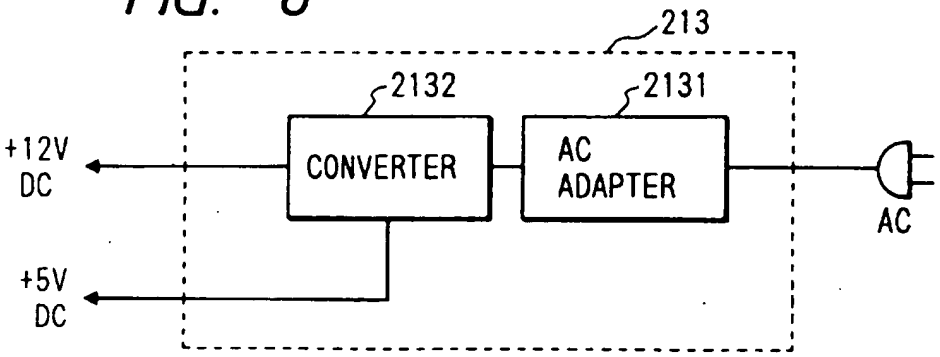


FIG. 7

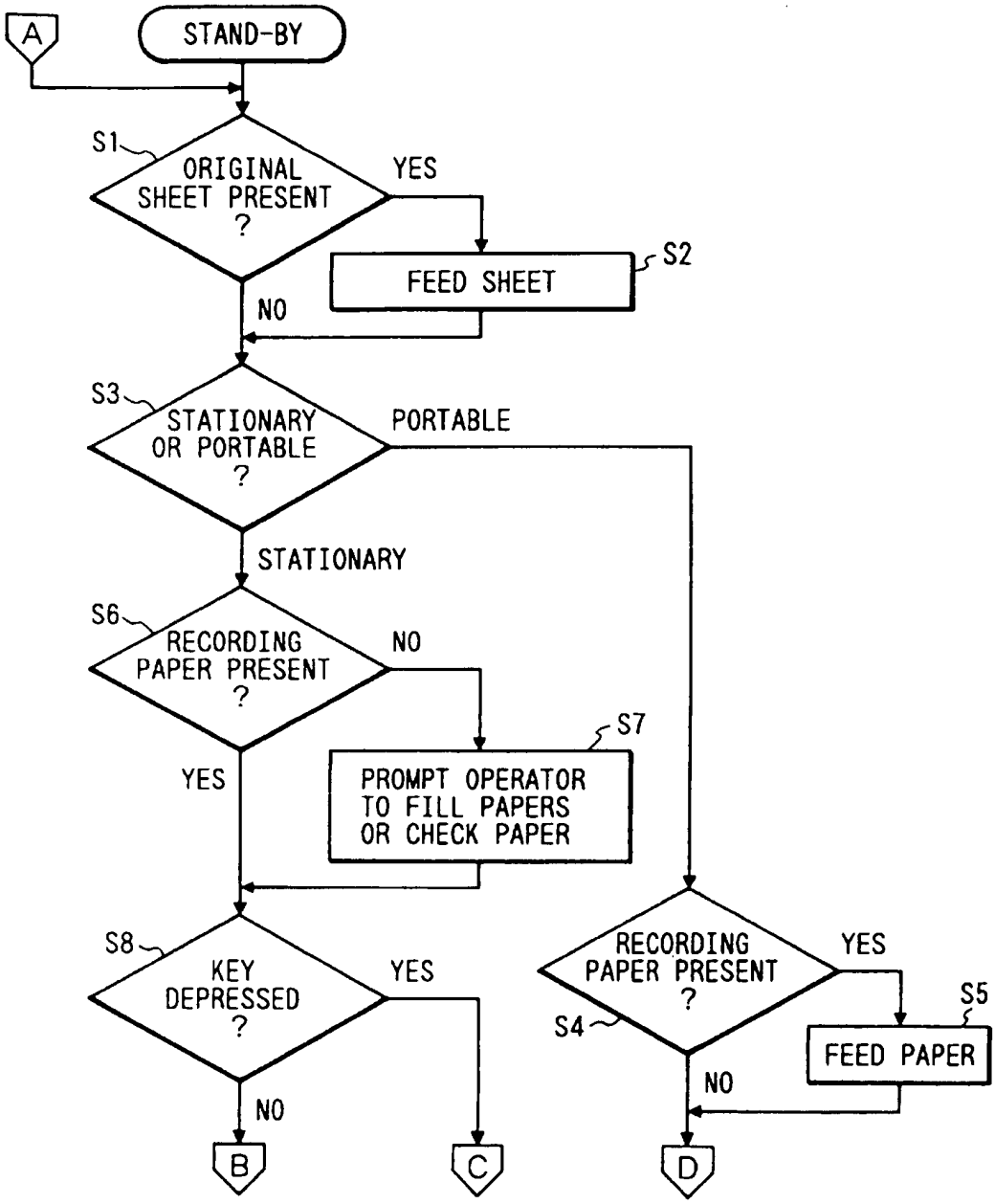

A
STAND-BY
S1
ORIGINAL SHEET PRESENT ?
YES
S2
FEED SHEET
NO
S3
STATIONARY OR PORTABLE ?
PORTABLE
STATIONARY
S6
RECORDING PAPER PRESENT ?
NO
S7
PROMPT OPERATOR TO FILL PAPERS OR CHECK PAPER
YES
S8
KEY DEPRESSED ?
YES
NO
B
C
RECORDING PAPER PRESENT ?
YES
S4
S5
FEED PAPER
NO
D

FIG. 8

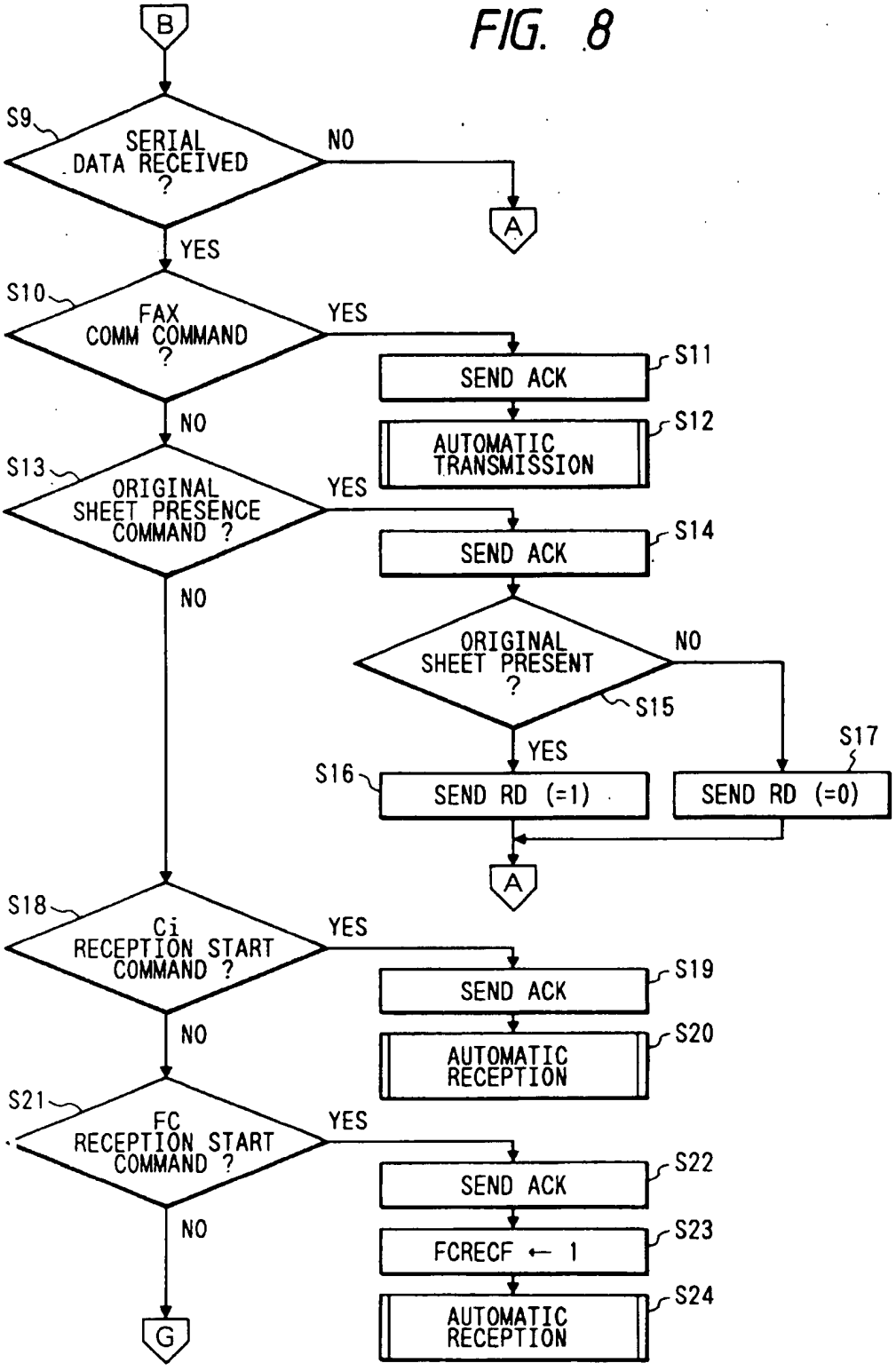

B
S9
SERIAL DATA RECEIVED ?
NO
A
YES
S10
FAX COMM COMMAND ?
YES
SEND ACK
S11
NO
AUTOMATIC TRANSMISSION
S12
S13
ORIGINAL SHEET PRESENCE COMMAND ?
YES
SEND ACK
S14
NO
ORIGINAL SHEET PRESENT ?
NO
S15
S17
YES
S16
SEND RD (=1)
SEND RD (=0)
A
S18
Ci RECEPTION START COMMAND ?
YES
SEND ACK
S19
NO
AUTOMATIC RECEPTION
S20
S21
FC RECEPTION START COMMAND ?
YES
SEND ACK
S22
NO
FCRECF ← 1
S23
AUTOMATIC RECEPTION
S24
G

FIG. 9

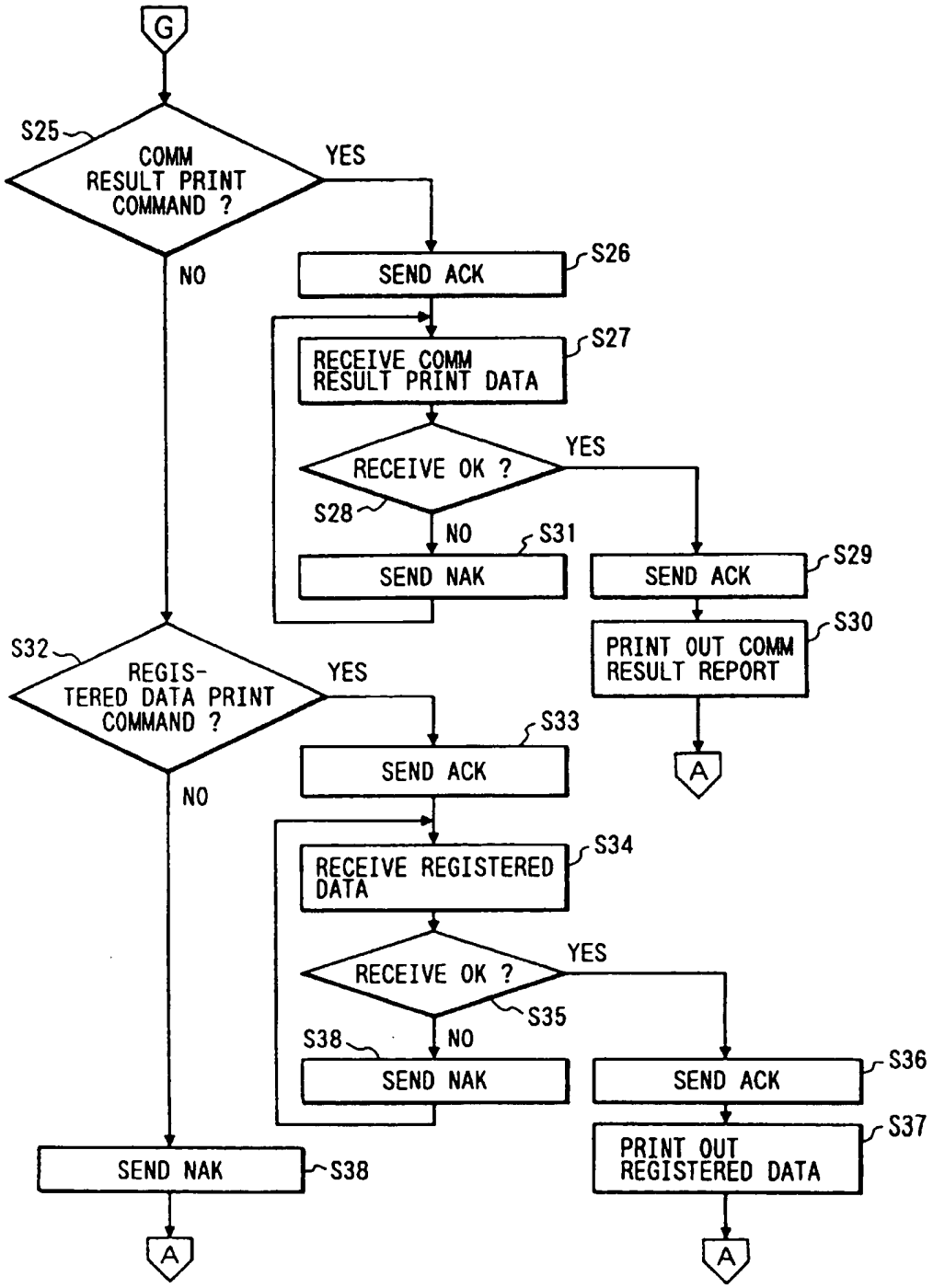

G
S25
COMM RESULT PRINT COMMAND ?
YES
NO
SEND ACK
S26
RECEIVE COMM RESULT PRINT DATA
S27
RECEIVE OK ?
YES
S28
NO
S31
SEND NAK
SEND ACK
S29
PRINT OUT COMM RESULT REPORT
S30
A
S32
REGIS-TERED DATA PRINT COMMAND ?
YES
NO
S33
SEND ACK
RECEIVE REGISTERED DATA
S34
RECEIVE OK ?
YES
S35
S38
NO
SEND NAK
SEND ACK
S36
PRINT OUT REGISTERED DATA
S37
SEND NAK
S38
A
A

FIG. 10

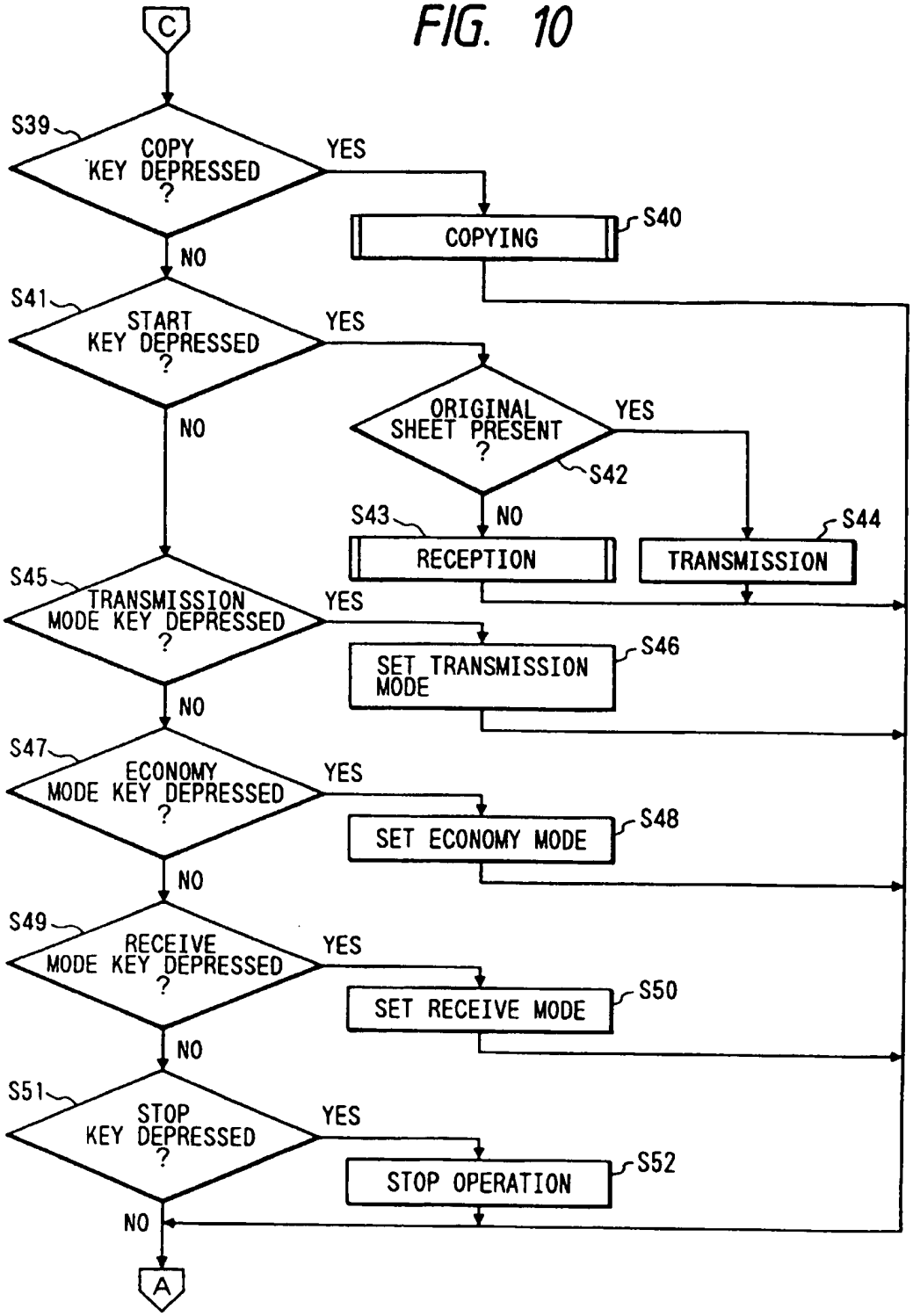

C
S39
COPY KEY DEPRESSED ?
YES
S40
COPYING
NO
S41
START KEY DEPRESSED ?
YES
NO
ORIGINAL SHEET PRESENT ?
YES
S42
S43
NO
S44
RECEPTION
TRANSMISSION
S45
TRANSMISSION MODE KEY DEPRESSED ?
YES
S46
SET TRANSMISSION MODE
NO
S47
ECONOMY MODE KEY DEPRESSED ?
YES
S48
SET ECONOMY MODE
NO
S49
RECEIVE MODE KEY DEPRESSED ?
YES
S50
SET RECEIVE MODE
NO
S51
STOP KEY DEPRESSED ?
YES
S52
STOP OPERATION
NO
A

FIG. 11

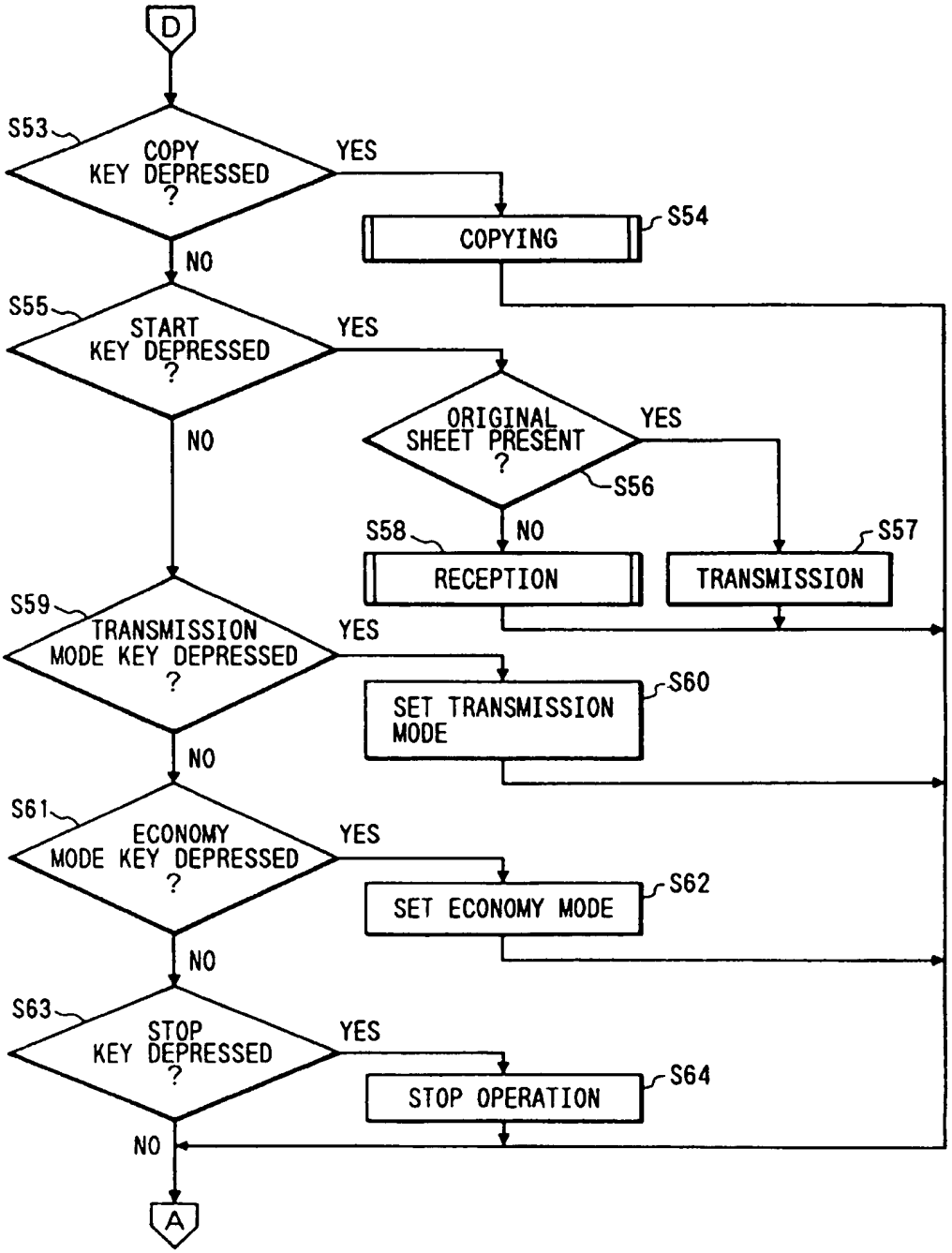

D
S53
COPY KEY DEPRESSED ?
YES
S54
COPYING
NO
S55
START KEY DEPRESSED ?
YES
ORIGINAL SHEET PRESENT ?
YES
S56
NO
S58
NO
S57
RECEPTION
TRANSMISSION
S59
TRANSMISSION MODE KEY DEPRESSED ?
YES
S60
SET TRANSMISSION MODE
NO
S61
ECONOMY MODE KEY DEPRESSED ?
YES
S62
SET ECONOMY MODE
NO
S63
STOP KEY DEPRESSED ?
YES
S64
STOP OPERATION
NO
A

FIG. 13

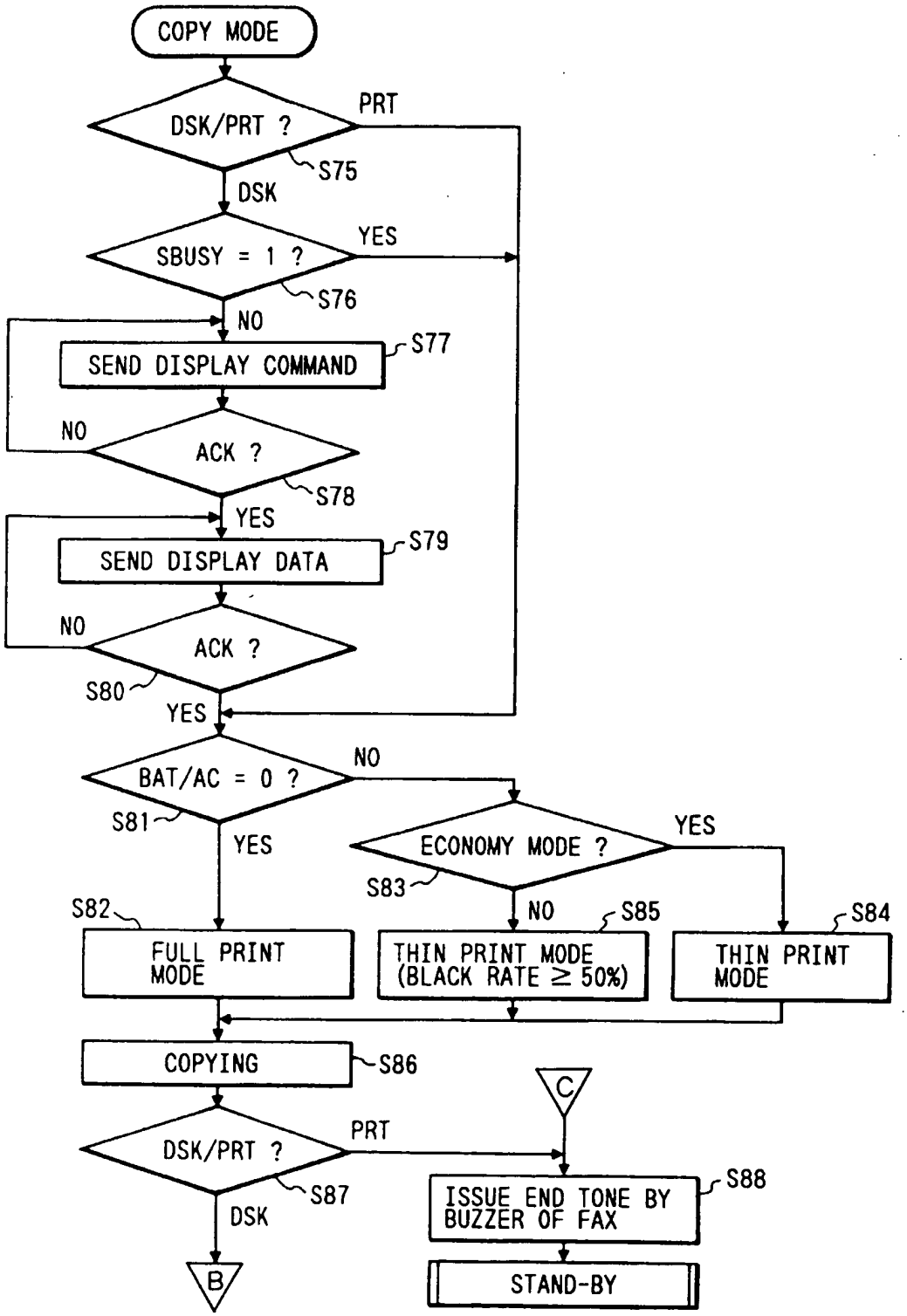
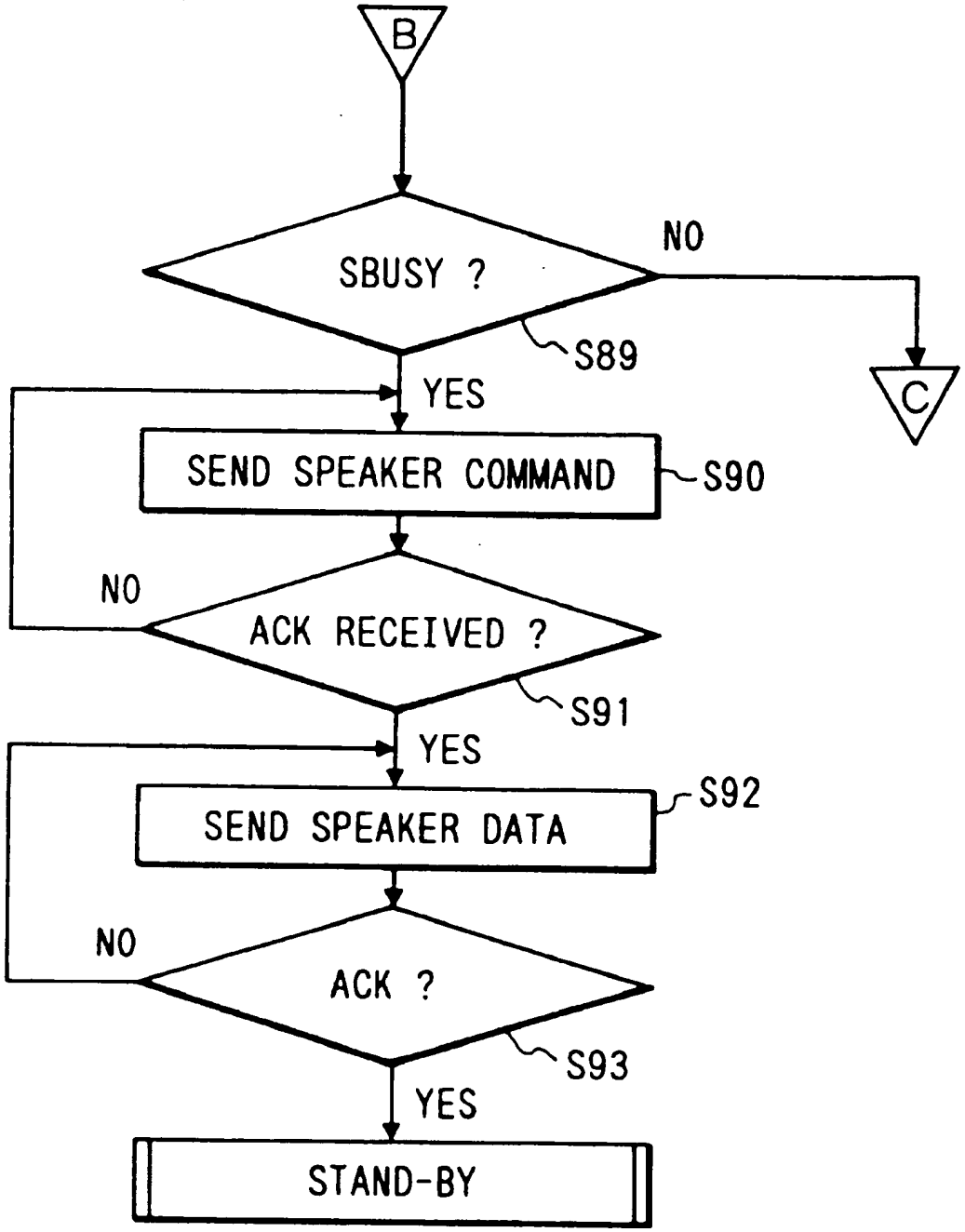

COPY MODE
DSK/PRT ?
PRT
S75
DSK
SBUSY = 1 ?
YES
S76
NO
SEND DISPLAY COMMAND
S77
NO
ACK ?
S78
YES
SEND DISPLAY DATA
S79
NO
ACK ?
S80
YES
BAT/AC = 0 ?
NO
S81
YES
ECONOMY MODE ?
YES
S83
NO
S85
S84
S82
FULL PRINT MODE
THIN PRINT MODE (BLACK RATE ≥ 50%)
THIN PRINT MODE
COPYING
S86
C
DSK/PRT ?
PRT
S87
DSK
ISSUE END TONE BY BUZZER OF FAX
S88
B
STAND-BY

FIG. 14


B
SBUSY ?
NO
S89
C
YES
SEND SPEAKER COMMAND
S90
NO
ACK RECEIVED ?
S91
YES
SEND SPEAKER DATA
S92
NO
ACK ?
S93
YES
STAND-BY

PROGRAM FOR EXTERNALLY CONTROLLING A COMMUNICATION APPARATUS

This application is a divisional of U.S. application Ser. No. 07/952,946, filed Sep. 28, 1992, which issued as U.S. Pat. No. 5,825,505, on Oct. 20, 1998.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a facsimile apparatus, wherein functions required as a portable facsimile apparatus can be separated from those required as a stationary facsimile apparatus used on a desk, the main body (FAX) of the facsimile apparatus has minimum functions as the portable facsimile apparatus, an external device having functions of realizing the stationary facsimile apparatus is connected to the main body in use on the desk, thereby using the facsimile apparatus for both stationary and portable applications.

2. Related Background Art

Conventional portable facsimile apparatuses have one of the following two arrangements. One arrangement has all functions of realizing a facsimile apparatus used on a desk, and the other arrangement has only minimum functions such as transmission and reception functions.

Along with the development of the information-oriented society, facsimile apparatuses are often used in places except for their original installation places. Demand has arisen for developing portable facsimile apparatuses which do not specify the installation places. A portable facsimile apparatus having minimum functions such as transmission and reception functions is proposed. Since this portable facsimile apparatus, however, has the minimum functions, it cannot provide necessary functions enough to serve as a desktop facsimile apparatus. When a portable facsimile apparatus is added to a desktop facsimile apparatus, the storage space of the portable facsimile apparatus not in use is wasted, resulting in high cost.

A portable facsimile apparatus having all the functions to serve as a desktop apparatus may be considered as a portable facsimile apparatus which can be used on a desk. Since unnecessary functions are included in the apparatus, the overall weight and size are undesirably increased during carrying.

SUMMARY OF THE INVENTION

The present invention has been made in consideration of the above situation, and has as its object to provide an image communication apparatus which can be used for both portable and stationary applications.

It is another object of the present invention to provide an image communication apparatus in which the overall weight and size of the portable main body can be reduced.

It is still another object of the present invention to provide a recording apparatus for performing printing by an optimal printing scheme in accordance with the type of power source and operating states, and an image communication apparatus incorporating the recording apparatus.

It is still another object of the present invention to provide a portable battery-driven image communication apparatus which is free from system resetting caused by variations in voltage and can effectively minimize power consumption of the battery.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the arrangement of a main body according to the first embodiment of the present invention;

FIG. **2** is a block diagram showing the arrangement of an external device according to the first embodiment;

FIG. **3** is a block diagram showing the arrangement of contacts of the first embodiment;

FIGS. **4**A and **4**B are perspective views of the first embodiment;

FIGS. **5**A to **5**C are block diagrams showing the arrangements of a power source of the main body of the first embodiment;

FIG. **6** is a block diagram showing the arrangement of a power source of an external device of the first embodiment;

FIG. **7** is a flow chart showing a facsimile operation of the first embodiment;

FIG. **8** is a flow chart showing the facsimile operation of the first embodiment;

FIG. **9** is a flow chart showing the facsimile operation of the first embodiment;

FIG. **10** is a flow chart showing the facsimile operation of the embodiment;

FIG. **11** is a flow chart showing the facsimile operation of the first embodiment;

FIG. **12** is a flow chart showing a reception or receive mode of the first embodiment;

FIG. **13** is a flow chart showing a copy mode of the first embodiment;

FIG. **14** is a flow chart showing the copy mode of the first embodiment;

FIG. **15** is a flow chart showing a power-ON operation of the first embodiment;

FIG. **16** is a flow chart showing the power-ON operation mode of the first embodiment;

FIG. **17** is a flow chart showing a transmission mode in which a transmission command is received by the main body of the first embodiment;

FIG. **18** is a block diagram showing power source determination schemes of the first embodiment;

FIG. **19** is a block diagram showing a scheme for determining whether the facsimile apparatus is a stationary or portable one;

FIG. **20** is a flow chart showing a stand-by operation of the external device of the first embodiment;

FIG. **21** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **22** is a flow chart showing the stand-by operation of the external device of the first embodiment;

FIG. **23** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **24** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **25** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **26** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **27** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **28** is a flow chart showing the stand-by operation of the external device of the embodiment;

FIG. **29** is a flow chart showing the operation in a function mode of the external device of the embodiment;

FIG. **30** is a flow chart showing the operation in the function mode of the external device of the embodiment;

FIG. **31** is a flow chart showing a connection check mode of the external device of the first embodiment;

FIG. **32** is a block diagram showing the arrangement of an external device according to the second embodiment of the present invention;

FIG. **33** is a block diagram showing another arrangement of contacts of the second embodiment;

FIG. **34** is a block diagram showing the arrangement of a power source of the external device of the second embodiment;

FIG. **35** is a flow chart showing a routine different from that of the facsimile operation of the first embodiment according to the second embodiment;

FIG. **36** is a flow chart showing a copy mode according to the second embodiment;

FIG. **37** is a block diagram showing electrical connections when the main body is connected to the external device;

FIGS. **38**A and **38**B are views illustrating an image obtained in a normal print mode and an image obtained in a thin print mode;

FIGS. **39**A and **39**B are graphs showing a relationship between battery discharge characteristics and an operation for warning a battery remaining amount by a warning voltage;

FIGS. **40**A and **40**B are graphs showing another relationship between battery discharge characteristics and an operation for warning a battery remaining amount by a warning voltage;

FIGS. **41**A and **41**B are graphs showing still another relationship between battery discharge characteristics and an operation for warning a battery remaining amount by a warning voltage;

FIG. **42** is a block diagram showing the third embodiment;

FIG. **43** is a plan view showing the arrangement of a console panel of the third embodiment;

FIG. **44** is a flow chart showing PIX reception according to the third embodiment; and

FIG. **45** is a flow chart showing printing in a record mode for battery according to the third embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[First Embodiment]

The first embodiment of the present invention will be described in detail with reference to the accompanying drawings.

The present invention comprises a main body and an external device, and FIG. **1** is a block diagram of the main body.

Referring to FIG. **1**, a CPU **11** has a function of controlling the overall operation of the facsimile apparatus according to programs stored in a ROM **12**, i.e., a function of controlling a RAM **13**, a first console unit **14**, a reader **15**, a recorder **16**, a driver **17**, a modem **18**, a first NCU **19**, a first sensor unit **112**, contacts (FAX) **113**, and a buzzer **131**. At the same time, the CPU **11** has a serial data communication interface and performs various data communications with other apparatuses through the contacts (FAX) **113**.

The RAM **13** stores binary image data read by the reader **15** and stores binary data recorded by the recorder **16**. The binary image data stored in the RAM **13** is modulated by the modem **18** and transmitted from a subscriber line **110** through the first NCU **19**. A signal received through the subscriber line **110** is demodulated by the modem **18** through the first NCU **19**, and the demodulated binary data is stored in the RAM **13**.

The first console unit **14** includes a transmission/reception start key, a mode key for designating an image quality mode such as fine and standard modes of the image to be transmitted, a copy key for performing a copy operation, an economy key for designating an energy-saving mode in recording/printing in use of a battery, and a stop key for stopping the operation of the main body. The CPU **11** always detects the states of these keys and controls the respective components in accordance with the states of the keys.

The reader **15** includes a CCD or contact image sensor (CS), an IC, and a binarizing circuit. The reader **15** causes the CCD or CS to convert the read data into binary data under the control of the CPU **11** and sequentially sends the binary data to the RAM **13**.

The recorder **16** includes a DMA controller, a B4/A4 size thermal head, and an IC. The recorder **16** reads out the recorded data from the RAM **13** under the control of the CPU **11** and prints out the recorded data as a hard copy.

The driver **17** includes a stepping motor for driving feed/discharge rollers in the reader **15** and the recorder **16**, gears for transmitting the driving force of the motor, and a driver circuit for controlling the motor.

The modem **18** includes G3, G2, G1, and old FM modems, and a clock generator connected to these modems. The modem **18** modulates the transmission data stored in the RAM **13** under the control of the CPU **11** and outputs the modulated data to the subscriber line **110** or a mobile communication unit **111** through the first NCU **19**. In addition, the modem **18** receives an analog signal from the subscriber line **110** or the mobile communication unit **111** through the first NCU **19**, demodulates it, and stores it in the RAM **13**. The mobile communication unit is defined as a radio communication unit such as a portable telephone or a mobile telephone, and the mobile communication line is defined as a line used for the portable telephone and the mobile telephone.

The first NCU **19** comprises a DC loop circuit and a 2-to-4 wire converter and connects the subscriber line **110** or the mobile communication unit **111** to the modem **18**. The subscriber line **110** is connected to the first NCU **19**.

The mobile communication unit **111** is a line for mobile communicating means connected to the first NCU **19**.

The first sensor unit **112** includes a recording paper width sensor, a recording paper presence sensor, an original sheet width sensor, and an original sheet presence sensor. The first sensor unit **112** detects the states of the original sheet and the recording paper under the control of the CPU **11**.

The contacts (FAX) **113** serve as an interface for exchanging signals with the main body and the external device and supplying power, and a detailed description of the contacts (FAX) **113** will be made later.

A power source **114** supplies the power to the respective components. More specifically, the power source **114** supplies a DC voltage of +12 V by means of a battery, an AC power source, or a car battery. The power source **114** will be described in detail later with reference to FIGS. **5**A to **5**C.

A voltage converter **130** includes a series regulator, a switching regulator, a DC/DC converter, converts the DC voltage of +12 V from the power source **114** into a DC voltage of +5 V, and outputs the DC voltage of +5 V.

The buzzer **131** comprises a buzzer and a buffer driver and generates a warning tone under the control of the CPU **11**.

A voltage monitor **133** includes a voltage setting circuit, a comparator, and an LED flash ON and OFF driver. The voltage monitor **133** monitors the DC voltage of +12 V input from the power source **114** and flashes an LED **134** ON and OFF when the input voltage becomes lower than the set voltage.

The LED **134** is driven by the voltage monitor **133**. When the voltage from the power source **114** becomes lower than the set voltage, the LED **134** informs it to the user.

The external device will be described with reference to the block diagram of FIG. **2**.

A CPU **21** has a function of controlling the overall operation of the main body in accordance with programs stored in a ROM **22**, i.e., a function of controlling a RAM **23**, a non-volatile RAM **24**, a character generator (CG) **25**, a message generator **26**, a message recorder **27**, a second console unit **28**, a display **29**, a second sensor unit **210**, a second NCU **211**, a select signal sender **215**, and a speaker **216**. The CPU **21** has a serial data communication interface and exchanges various data with other apparatuses through contacts (external) **214**.

The RAM **23** is used as a serial data communication data buffer, a work area of the CPU **21**, and the like.

The non-volatile RAM **24** comprises, e.g., an EEPROM or an SRAM backed up by a battery. The non-volatile RAM **24** can store data even if the voltage supplied to the external device is withdrawn. More specifically, the non-volatile RAM **24** stores, e.g., data sent from other apparatuses in the form of serial data, data corresponding to the name of destination and the telephone number of the destination input through the second console unit **28**, and other registered data.

The CG **25** comprises a ROM for storing characters such as JIS and ASCII codes. The CG **25** reads out character data corresponding to a predetermined code in response to 2-byte data, as needed, under the control of the CPU **21**.

The message generator **26** stores prestored message data and sends the message data to a line **212** through the second sensor unit **210** under the control of the CPU **21**.

The message recorder **27** records or reproduces the analog signal (on the line) input through the second NCU **211** under the control of the CPU **21**. The message recorder **27** comprises, e.g., a magnetic tape or a memory.

The second console unit **28** includes a 3-mode (i.e., manual, FAX/TEL (facsimile/telephone or F/T) auto change, and automatic answer/record phone modes) selection switch, a ten-key pad, a one-touch key, and a function key.

The display **29** includes a liquid crystal display (LCD) and displays various pieces of information under the control of the CPU **21** on the LCD. The CPU **21** has a real-time clock for reading the current time and displaying it on the LCD.

The second sensor unit **210** includes a sensor (e.g., a reflection sensor) for detecting the remaining amount of recording paper. The second sensor unit **210** has a function of informing detection data to the CPU **21**.

The second NCU **211** has a function of causing a CML relay to switch a transmission signal TX and a reception signal RX at the contacts (external) **214** through a jack for connecting an external telephone set to the line **212**, an OFF-hook detector of this telephone set, a CI signal detector connected to the OFF-hook detector, an FC signal (a ringing signal from a 1,300-Hz facsimile network) detector, a CNG signal detector **25**, the message recorder **27** and a 2-to-4 wire converter.

A power source **213** receives an AC voltage and generates DC voltages of +12 V and +5 V. The DC voltage of +12 V is supplied to the contacts (external) **214**. Note that the details of the power source **213** are shown in FIG. **6**.

The contacts (external) **214** comprise **12** contacts, i.e., contacts of +12 V, GND (+12 V), +5 V, GND (+5 V), TX, RX, serial TX (STX), serial RX (SRX), MBUSY, SBUSY, BAT/AC, DSK/PRT signals or voltages.

The select signal sender **215** sends out select signals such as pulse dialer and a tone dialer through the second sensor unit **210** under the control of the CPU **21**.

The speaker **216** outputs various message signals under the control of the CPU **21**.

A quasi-CI generator **217** outputs a quasi-CI signal to the external telephone set under the control of the CPU **21**.

The external device is connected to the line **212**, the external telephone set, and the AC power source.

The details of the external device have been described above.

FIG. **3** shows the contacts between the FAX main body and the external device according to the present invention.

Contacts **31** connect the contacts (FAX) **113** of FIG. **1** to the contacts (external) **214** of FIG. **2** so as to connect the FAX main body to the external device and exchange signals therebetween and supply voltages thereto.

The contacts **31** comprise the contacts (FAX) **113** and the contacts (external) **214** and perform the following interface operations. A voltage of +12 V is applied from the external device to the main body. GND (+12 V) is common to the main body and the external device. A voltage of +5 V is regulated by the voltage of +12 V in the main body and is input to the external device. The transmission signal TX is modulated by the modem in the main body and is sent onto the line through the second NCU **211**. The reception signal RX is received by the modem **18** through the second NCU **211** in the external device. A signal line STX is used for serial data transmitted from the main body to the external device. A signal line SRX is used for serial data transmitted from the external device to the main body. The MBUSY signal is a signal for informing a serial data receive enable mode in the main body. The SBUSY signal is a signal for informing a serial data receive enable mode in the external device. The signal BAT/AC causes to send a signal representing the type of power source as the battery, AC power source or car battery to the CPU **11** in the main body. The signal DSK/PRT causes to send, from the external device or the battery to the CPU **11** in the main body, a signal for determining whether the main body is independently used or is used upon connection of the external device thereto.

FIG. **4** is a view showing the outer appearance of the first embodiment.

A facsimile main body **41** is a facsimile main body in a portable state and is constituted by the block diagram shown in FIG. **1**. A contact interface **411** is operated when the facsimile main body is set in the portable state. A facsimile external device **42** is used when the facsimile main body is set in the stationary state and is constituted by the block diagram shown in FIG. **2**. A contact interface **421** is operated when the facsimile main body is used in the stationary state. A storage portion **422** stores a roll of paper. An AC outlet **423** is connected to a battery charger for charging a battery when the apparatus is used in the portable state, thereby charging the battery. A stationary state **43** shows that the portable facsimile main body is combined with the stationary external device and is used on the desk.

Handling of the recording paper will be described below. In the portable state wherein only the main body is used, the recording paper is manually fed. When the recording paper is inserted, the main body feeds the recording paper by 2 to 3 mm. At the start of the reception or copy operation, the recording paper is fed. In the portable state, a cut sheet is used as the recording paper. The size of the cut sheet to be used can be designated by the operator in advance. In the stationary state wherein the main body is combined with the external device, the leading end of the roll of paper stored in

the external device is inserted in the facsimile main body upon a power-ON operation. The main body feeds the leading end of the inserted recording paper by 2 to 3 mm. The recording paper is then fed at the start of a reception or copy operation.

FIGS. **5A** to **5C** are views showing the arrangements of the power source **114** of the main body in detail. The power source is used in the three arrangements shown in FIGS. **5A** to **5C** and supplies a voltage of +12 V.

A power source **1141** is constituted by a DC battery **1141***a* of +12 V. A power source **1142** is constituted by an AC adapter **1142***a* for converting an AC voltage into a DC voltage of +12 V. A power source **1143** is constituted by a car battery adapter **1143***a* for converting a DC voltage from the car battery into a stable DC voltage of +12 V.

FIG. **6** shows the power source **213** in detail. The power source **213** generates a DC voltage of +12 V and a DC voltage of +5 V from the AC voltage. The DC voltage of +12 V is applied to the contacts (external) **214**.

In the above arrangement, the operation of the apparatus of the first embodiment will be described with reference to a flow chart in FIG. **7**. This sequence is stored as a program of the CPU **11** in the ROM **12**.

A normal operation will be described first, and then an operation upon the power-ON operation will be described next. The stand-by mode is set upon the power-ON operation. It is determined in step **S1** whether the original sheet is present. If YES in step **S1**, the flow advances to step **S2** to feed and set the original sheet.

However, if the original sheet is absent, an original sheet is set, and it is determined in step **S3** according to the signal DSK/PRT from the contacts whether the apparatus is set portable or stationary. The signal DSK/PRT is a signal for determining whether the apparatus is set stationary or portable, and the signal DSK/PRT is shown in FIG. **19** in detail.

Referring to FIG. **19**, the signal DSK/PRT in the main body is pulled up to the voltage of +5 V and is input to an input port in the CPU. In the stationary state wherein the main body is connected to the external device, the signal DSK/PRT is grounded through the contacts, and the signal DSK/PRT=0 (Low level) is set. In the portable state wherein the main body is disconnected from the external device, the contacts are open, so that the signal DSK/PRT=1 (High-level) is set.

If the signal DSK/PRT=1 in step **S3**, the CPU determines that the current state is the portable state, and the flow advances to step **S4**. It is determined in step **S4** whether the recording paper is present. If YES in step **S4**, the flow advances to step **S5** to fed and set the recording paper. However, if NO in step **S4**, the recording paper is set, and a flow D (FIG. **11**) is initiated.

If the signal DSK/PRT=0 in step **S3**, then the CPU determines the stationary state wherein the main body is connected to the external device. The flow advances to step **S6** to determine whether the recording paper is present. If NO in step **S6**, a display command is sent to the display in step **S7** to prompt the operator to confirm the replacement or state of recording paper (e.g., to fill paper or check paper). At the same time, a speaker command is sent to the speaker. When the recording paper is set and after the display and speaker commands are sent out, the flow advances to step **S8**.

It is determined in step **S8** whether any one of the keys in the first console unit **14** is depressed. If YES in step **S8**, the operation for determining a key input in the stationary state in a flow C (FIG. **10**) is performed. However, if NO in step **S8**, a flow B (FIG. **8**) is initiated.

In the flow B, when serial data is received from the external device in step **S9**, a FAX communication command, an original sheet presence command, a CI reception start command, an FC reception start command, a communication result report print command (communication result print command), and a registered data print command are determined in steps **S10**, **S13**, **S18**, **S21**, **S25** (FIG. **9**), and **S32** (FIG. **9**), respectively, and the corresponding operations are performed. When the received command is not one of the commands described above, an NAK signal (i.e., a signal representing that the command signal is not acknowledged) is output to the external device in step **S38** (FIG. **9**), and the flow returns to the stand-by state (FIG. **7**).

When the FAX communication command is received in step **S10**, an ACK signal (i.e,. a signal representing the command signal is acknowledged) is sent out in step **S11**, and automatic transmission is performed in step **S12**.

When the original sheet presence command is received in step **S13**, an ACK signal is sent out in step **S14**. If the presence of the original sheet is detected by the original presence sensor (DS) of the FAX main body in step **S15**, a serial signal RDS=1 is sent out to the external device, and the flow returns to the stand-by state (FIG. **7**).

If the CI reception start command is received in step **S18**, an ACK signal is sent out in step **S19**, and automatic reception is performed in step **S20**.

If the FC reception start command is received in step **S21**, an ACK signal is sent out in step **S22**. In step **S23**, a flag FCRECF representing FC reception is set at logic "1" to indicate that FC reception is made. Automatic reception is performed in step **S24**.

If the communication result print command is received in step **S25** (FIG. **9**), an ACK signal is output in step **S26**. Coded data of communication result report data is received as serial data from the external device in step **S27**. If the received data is correct, i.e., if the data reception is O.K. in step **S28**, an ACK signal is output in step **S29**. The coded data is developed into an image in step **S30** to print out the communication result report in a predetermined format, and the flow returns to the stand-by state (FIG. **7**). If NO in step **S28**, an NAK signal is output in step **S31** to receive data again. Whether the received data is correct is determined by detection of a check sum and a signal end mark.

If the registered data print command is received in step **S32**, the sum registered data print operation as in the communication result report in steps **S26** to **S31** is performed in steps **S33** to **S38**.

If the received command is a signal except for the FAX communication command, the original sheet presence command, the CI reception start command, the FC reception start command, the communication result report command (communication result print command), and the registered data print command, a signal NAK (i.e,. a signal representing the input command signal is not acknowledged) is sent out to the external device in step **S38**, and the flow returns to the stand-by state (FIG. **7**).

An operation flow C (FIG. **10**) in the stationary state will be described below.

It is determined in step **S39** whether the copy key is depressed. If YES in step **S39**, the copy mode is set in step **S40**.

If NO in step **S39**, it is determined in step **S41** whether the start key is depressed. If YES in step **S41**, it is determined in step **S42** whether the original sheet for transmission is present. If YES in step **S42**, manual facsimile transmission is performed in step **S43**. If NO in step **S43**, the reception mode is set in step **S44**.

If NO in step S41, it is determined in step S45 whether a transmission mode key is depressed. If YES in step S45, the transmission mode (fine or standard) is set in step S46.

If NO in step S45, it is determined in step S47 whether an economy key is depressed. If YES in step S47, the economy mode is set in step S48 to perform a thin print operation in the print mode.

If NO in step S47, it is determined in step S49 whether the receive mode key is depressed. If YES in step S49, the receive mode (manual, FAX/TEL change, or automatic answer/record phone mode) is set in step S50.

If NO in step S49, it is determined in step S51 whether a stop key is depressed. If YES in step S51, the operation is immediately stopped in step S52, and the flow returns to the stand-by mode (FIG. 7).

If NO in step S51, i.e., if any key input is not detected, the flow also returns to the stand-by state (FIG. 7).

The operation flow D (FIG. 11) in the portable mode will be described below.

It is determined in step S53 whether the copy key is depressed. If YES in step S53, the copy mode is set in step S54.

If NO in step S53, it is determined in step S55 whether the start key is depressed. If YES in step S55, it is determined in step S56 whether an original sheet for transmission is present. If YES in step S56, manual facsimile transmission is performed in step S57. If NO in step S56, the receive mode is set in step S58.

If NO in step S55, it is determined in step S59 whether the transmission mode key is depressed. If YES in step S59, the transmission mode (fine or standard) is set in step S60.

If YES in step S59, it is determined in step S61 whether the economy key is depressed. If YES in step S61, the economy mode is set in step S62 to perform a thin print operation in the print mode.

If NO in step S61, it is determined in step S63 whether the stop key is depressed. If YES in step S63, the operation is immediately stopped in step S64, and the flow returns to the stand-by state (FIG. 7).

If NO in step S63, i.e., if any key input is not detected, the flow also returns to stand-by state (FIG. 7).

The reception operations in steps S43 (FIG. 10) and S58 (FIG. 11) will be described in detail with reference to a flow chart in FIG. 12.

When the reception or receive mode is set, conventional facsimile message reception is performed in step S65. Upon reception of an RTC (consecutive transmission of six EOLS), it is determined in steps S66, S67, and S68 whether signals MPS, EOM, and EOP are detected. If NO in steps S66, S67, and S68, an error tone is issued and the error lamp is turned on in step 69. The flow then returns to the stand-by state (FIG. 7).

If the signal EOP is detected in step S68, a signal MCF is output in step S70 if no image error is present. If an image error is present, an end tone is issued in step S70. The flow then returns to the stand-by state.

If the signal MPS or EOM is detected in step S66 or S67, it is determined in step S71 whether a time T1 has elapsed. The time T1 is defined as a period for setting the recording paper for the next facsimile message reception when manual reception using a cut sheet as the recording paper is to be performed. The time T1 is set to be about 9 seconds in consideration of the MCF reception time range on the transmission side. If NO in step S71, it is determined in step S72 whether the recording paper is set. If YES in step S72, the signal MCF is sent out to return to the facsimile message reception operation of step S65. However, if NO in step S71, a paper insertion tone for prompting the user to set the recording paper is generated in step S73, and the flow returns to step S71 to determine whether the time T1 has elapsed. If YES in step S71, a signal DCN is sent out in step S74. The error tone is issued and the error lamp is turned on in step S69. The flow then returns to the stand-by state.

The copy operation will be described in detail with reference to a flow chart in FIG. 13.

When the copy mode is set, it is determined in step S75 whether the signal DSK/PRT from the contacts is set high (PRT=1) or low (DSK=0). If YES in step S75, operations from step S81 are performed. However, if NO in step S75, the SBUSY signal in the external device is checked in step S76. If the SBUSY signal is set at logic "1", the external device is set in a state wherein a command cannot be received. In this case, no command is transmitted to the external device, and operations from step S81 are performed. However, if the SBUSY signal is set at logic "0", a display command is output to the external device in step S77. The display command is output a maximum of three times until an ACK signal is received.

When the ACK signal is received in step S78, display data is sent out in step S79. The data is transmitted a maximum of three times until an ACK signal is received in step S80. Upon reception of the ACK signal, it is determined in step S81 whether the signal BAT/AC from the contacts is set at logic "0". The signal BAT/AC is a signal for determining whether the power source is an AC power source or battery, and details of the signal BAT/AC are shown in FIG. 18.

Referring to FIG. 18, the signal BAT/AC in the main body is pulled up to a voltage of +5 V and is input to the input port of the CPU 11. When the AC power source is connected, the signal BAT/AC is grounded through the contacts and is therefore set to be the signal BAT/AC=0.

On the other hand, when the battery is connected, the signal BAT/AC is open through the contacts, and the signal BAT/AC=1 is set by the pull-up behavior in the main body. When a car battery is connected, the car battery switch is operated depending on the capacity of the car battery. If the car battery capacity is large, the switch is turned on, so that the signal BAT/AC=0 is set through the contacts. However, when the car battery capacity is small, the switch is turned off, so that the signal BAT/AC=1 is set through the contacts.

If the signal BAT/AC=0 in step S81, then a full print mode is set in step S82. However, if the signal BAT/AC=1 in step S81, then it is determined in step S83 whether the economy mode is set. If YES in step S83, the thin print mode is set in step S84. If NO in step S83, a mode for thinning the data only when the black rate is equal to or higher than 50% in one read line of the original sheet is set. After the any one of the modes in steps S82, S84, and S85 is set, a copy operation is performed in step S86. At the end of copying, it is determined in step S87 whether the signal DSK/PRT represents PRT or DSK. If PRT is determined in step S87, an end tone is issued by the buzzer of the FAX (main body) in step S88, and the flow returns to the stand-by state (FIG. 7). However, if DSK is determined in step S87, the content of the SBUSY signal is determined in step S89 (FIG. 14). If SBUSY=1, then operations from step S88 (FIG. 13) are performed. However, if SBUSY=0 in step S89, a speaker command and speaker data are sent out in steps S90 (FIG. 14) and S92 (FIG. 14) as in the display command and display data in steps S77 (FIG. 13) and S79. When an ACK signal is received in step S93, the stand-by state (FIG. 7) is set.

The thin print mode and the mode for thinning the data only when the black rate in one line is 50% or more are

energy-saving modes in use of a power source except for the AC power source. This also applies to the print operation of the facsimile message during reception.

During the operation in the copy mode, the line is switched to an external telephone set by the NCU.

The operation upon the power-ON operation will be described in detail with reference to a flow chart in FIG. **15**.

Each I/O, the SRAM **13**, and the like are initialized in step **S94**. If DSK/PRT=PRT in step **S95**, then the stand-by state (FIG. **7**) is set. On the other hand, if DSK/PRT=DSK, then the CPU waits until the SBUSY signal in the external device goes to logic "0" in step **S96**. If SBUSY=0, then an initial data request command is transmitted to the external device in step **S97**. This command is repeatedly transmitted a maximum of three times until an ACK signal is received in step **S98**. Initial data is received from the external device in step **S99**. If the sum of reception data is zero, it is determined that the reception data is correctly received, and an ACK signal is output in step **S102**. The input initial data is stored in the RAM **13** in step **S103**. A display command and display data are transmitted in steps **S104** to **S108** (FIG. **16**) as in steps **S77** and **S79** in FIG. **13**. The time is displayed on the display of the external device, and the flow advances to the stand-by state.

An operation upon reception of the transmission command will be described on the basis of a flow chart in FIG. **17**.

Upon reception of the transmission command, it is determined in step **S109** whether **35** seconds have elapsed. After a signal DIS is received in step **S110**, normal FAX transmission defined by the CCITT T-30 is performed. When the source device cannot recognize that the destination is FAX within 35 seconds in step **S109**, a redial command is sent out to the external device in step **S113**. When an ACK signal is received in step **S114**, the stand-by mode is set.

The operation of the external device will be described in detail with reference to a flow chart in FIG. **20**.

Upon a power-ON operation, each I/O, the SRAM **23**, the non-volatile RAM or EEPROM **24**, and the like are initialized in step **S115**. At this time, a flag FAXONF representing that the main body is connected to the external device is reset. The flag FAXONF represents that the main body is connected to the external device if FAXONF=1. Upon completion of initialization of the respective components, the flow advances to the stand-by mode.

In the stand-by mode, it is checked in step **S116** whether the main body is connected to the external device. This connection check operation will be described in detail later. If any key of the second console unit **28** is depressed in step **S117**, the flow advances to step **S118**. It is determined in steps **S118**, **S119**, **S120**, **S121**, and **S122** whether a one-touch key, an off-hook key, a function key, a mode key, and an automatic answer/record phone key are depressed. Control operations corresponding to the key inputs are performed and will be described in detail later. When the one-touch key is depressed, the CML relay of the second NCU **211** is turned on to form a loop between the line **212** and the external device (**S126** in FIG. **21**). It is determined in step **S127** whether the main body is connected to the external device. If YES in step **S127**, the flow advances to step **S128**. However, if NO in step **S127**, the flow advances to step **S137**. When the main body is connected to the external device, an original sheet presence command is sent from the SRX of the contacts (external) **214** to the main body at 9,600 bps in step **S128**. In step **S129**, a response signal is received from the main body (FAX). If this response signal is an ACK signal, the flow advances to step **S130**. Otherwise, the flow returns to step **S128** to send the original sheet presence command again. This command is transmitted a maximum of three times. Data from the FAX main body is received in step **S130**. If the received data represents RDS=1 in step **S131**, it represents an original sheet. However, if RDS=0, no original sheet is present in the FAX main body, and the flow advances to step **S137**.

In step **S132**, the select signal sender **215** calls a FAX one-touch dial destination stored in the SRAM **24**. The CPU in the main body waits in step **S133** until the MBUSY signal goes to logic "0" in step **S133**. If the MBUSY signal goes to logic "0", a FAX communication command is sent to the FAX main body a maximum of three times in step **S134** until signals ACK are received in steps **S135** and **S136**. Upon reception of the signals ACK, the flow returns to a stand-by state (FIG. **20**).

In step **S137**, the select signal sender **215** calls a TEL one-touch dial destination stored in the SRAM **24** as in the step **S132**. While the message on the line **212** is kept monitored, an on-hook state of the telephone set connected to the NCU is detected in step **S138**. If the off-hook operation is detected, the flow returns to the stand-by state (FIG. **20**).

A call operation using the off-hook key will be described below.

The CML relay is turned on in step **S139** (FIG. **22**) to form a loop with the line **212**. It is determined in steps **S140**, **S141**, and **S142** whether dial associated keys are depressed. If the one-touch key is depressed, operations from step **S127** (FIG. **21**) are performed. When one of the keys in the ten-key pad is depressed, a pulse or DTMF signal corresponding to the depressed key is sent from the select signal sender **215** to the line **212** in step **S143**. When the start key is depressed, the call operation is interrupted, and the flow advances to step **S144**. If FAXONF=0 in step **S144**, the main body is not connected to the external device. The facsimile transmission/reception operation need not be performed, and the flow returns to the stand-by state (FIG. **20**). However, if FAXONF=1, then the flow advances to step **S145**. The operations in steps **S145** to **S149** are the same as those in steps **S128** to **S131**. If an original sheet is present in the FAX main body in step **S149**, operations from step **S133** (FIG. **21**) are performed. Otherwise, operations from step **S138** (FIG. **21**) are performed.

When the function key is depressed, the function mode is set in step **S123**. The operation in the function mode will be described later.

When the mode key is depressed, the manual mode, the FAX/TEL auto change mode, the automatic answer/record phone mode 1, and the automatic answer/record phone mode 2 are switched every depression of the mode key in step **S124**. In this embodiment, mode selection is performed by software, but may be performed by a hardware slide switch or the like.

When the automatic answer/record phone key is depressed, the automatic answer/record phone mode is set in step **S125**. In the automatic answer/record phone mode, automatic answer/record phone operations such as recording and reproduction are performed.

The stand-by operations except for the key input will be described below.

When the FC signal (1,300 Hz) is detected in step **S150** (FIG. **23**), the flow advances to step **S151** (FIG. **28**). When the MBUSY signal goes to logic "0", the FC reception start command is transmitted to the FAX main body in step **S152**. Upon reception of the ACK signals in steps **S153** and **S154**, the CML is turned on in step **S155**. The line **212** forms a loop with the FAX side, and the flow returns to the stand-by state (FIG. **20**).

When the reception mode is a manual reception mode in step S156 (FIG. 23), and a specific signal such as a hooking or DTMF signal from the external device is detected in step S157, the flow advances to step S162. It is determined in step S158 whether the manual reception mode stored in the non-volatile RAM 24 is changed to the automatic reception mode. If NO in step S158, the flow returns to the stand-by mode (FIG. 20). In this case, no response is made until a key input is made. If YES in step S158, the switching time is set as data, e.g., 30 seconds, stored in the non-volatile RAM 24 in step S159. When the CI signal is continuously detected within 30 seconds (this value can be changed by a set value) in steps S160 and S161, the flow advances to step S162. Otherwise, the flow returns to the stand-by mode (FIG. 20). When the MBUSY signal goes to logic "0" in step S162, the CI reception start command is transmitted to the FAX main body in step S163. Upon reception of ACK signals in steps S164 and S165, the CML is turned on in step S166 to form a loop between the line 212 and the FAX side. The flow then returns to the stand-by state (FIG. 20).

When the reception mode is the FAX/TEL auto change mode in step S167 (FIG. 24), the CML is turned on in step S169 upon detection of the CI signal in step S168. A reply message 1 (Calling now. Please wait.) is sent out from the message generator 26 onto the line 212. Upon completion of this operation, when the FC signal and the CNG signal are detected in steps S170 and S171, processing operations in steps S151 (FIG. 28) and S162 (FIG. 23) are performed, respectively. When neither signals are detected, a quasi-CI (Ci) signal having a p-p value of 120V at the frequency of 16 Hz to 50 Hz is output to the external telephone set in step S172. Upon detection of the FC signal, the CNG signal, the lapse of sending time of quasi-CI signal which can be set by the user, and the on-hook state of the external telephone set in steps S170, S171, S173, and S174, processing operations are performed in steps S151 (FIG. 28), S162 (FIG. 23), S177, and S175, respectively. When the off-hook state is detected in step S174, the quasi-CI signal is disabled in step S175. The CML is turned off in step S176, and the line 212 is switched from the external device to the external telephone set. When the sending time of the quasi-CI signal exceeds the set time in step S173, the quasi-CI signal is disabled in step S177. A reply message 2 (No answer. Please send FAX.) is sent out to the line 212 in step S178, and operations from step S162 (FIG. 23) are performed.

When the reception mode is the automatic answer/record phone mode 1 in step S179, operations from step S162 (FIG. 23) are performed when the CNG signal is detected and any tone is not detected over a predetermined time settable by the user in steps S180 and S181.

When the reception mode is the automatic answer/record phone mode 2 in step S182 (FIG. 25), the CML is turned on in step S184 to form a loop between the external device and the line 212 to send out a reply message 3 (Your telephone set is connected to the automatic answer/record phone. Please leave a message after you hear a beep tone) on the line 212. The same operations as in steps S180 and S181 are performed in steps S186 and S187. Recording of the message is started by the message recorder 27 in step S188. When the CNG signal is detected in step S186 and any tone is not detected within the predetermined time in step S187, the flow advances to step S162 (FIG. 23). On the other hand, if an ROT (ReOrder Tone: a pulse signal may be output when the mating telephone set is released from the line, and this pulse signal is called a reorder tone), a BT (busy tone), polarity inversion are detected in steps S189, S190, and S191, respectively, message recording is stopped in step S192. The flow then returns to the stand-by state (FIG. 20).

When a command as serial data is received from the FAX main body through the contacts (external) 214 in step S193 (FIG. 26), the following signals are detected in steps S194, S200, S207, S214, and S221, respectively, and the corresponding operations are performed. These signals are the initial data request command, the communication result receive command, the display command, the speaker command, and the redial command.

If the command received in step S194 is the initial data request command, an ACK signal is sent back to the FAX main body in step S195, and then the initial data is sent in step S196. The initial data includes an external device version No., polling ID and closed net ID Nos. stored in the non-volatile RAM 24, a user name, and the telephone number of the telephone line connected to the external device. Of all pieces of the information of the initial data, necessary ones are displayed on the display. Responses to the initial data are to be received from the FAX main body in steps S197 and S198. In this case, when no response is received and a signal except for the ACK signal is received, the initial data is transmitted a maximum of three times. When the ACK signal is received, it is determined that the facsimile main body is connected to the external device. In step S199, the flag FAXONF is set at logic "1", and the flow returns to the stand-by state (FIG. 20). Otherwise, processing is ended with an error.

When the communication result receive command is received in step S200, an ACK signal is sent back in step S201. The communication result data is received in step S202. If the check sum of the reception data is O.K. in step S203, an ACK signal is sent out in step S204, and the reception data is stored in the SRAM 24 in a predetermined format in step S205. The flow returns to the stand-by state (FIG. 20). The communication result data includes a destination name, a destination telephone number, and the like. When the reception data is N.G. in step S203, an NAK signal is sent back to the FAX main body in step S206, and the communication result data is received again in step S202. The NAK signal is sent back a maximum of three times.

When the display command is received in step S207 (FIG. 27), the subsequent operations are the same as those in the communication result receive command described above. Display data reception in step S209 and an LCD display operation in step S212 will be described below. The operation in step S209 is an operation for receiving the display data, and the operation in step S212 is an operation for displaying the display data on the LCD.

When the speaker command is received in step S214, the same operations as in the communication result receive command described above are performed. A speaker operation data receiving operation in step S216 and a speaker driving operation in step S219 will be described. The operation in step S216 is an operation for receiving the speaker operation data, and the operation in step S219 is an operation for issuing a warning tone from the speaker on the basis of the received data.

When the redial command is received in step S221, an ACK signal is sent back in step S222, and operations form step S132 are performed.

When the received command is a command which cannot be acknowledged by the external device or a command representing an operation which cannot be performed by the external device, an NAK signal is sent back from the external device to the FAX main body in step S223.

The detailed operations of the external device in the stand-by state of this embodiment have been described.

Operations in the function mode in step S123 (FIG. 20) will be described in detail in FIG. 29.

The function modes are a registration mode and a print mode. When the registration mode is set in step S224, various data such as the current time, the user name, the telephone number of the connected telephone line, the polling ID No., the closed net ID No., the one-touch dial destination telephone number and its name, the destination telephone number and the name of an electronic telephone directory, the manual/automatic switching time in the manual reception mode described above, detection of the absence of any tone in the automatic answer/record phone mode, and the type of connection line are registered in the SRAM 24 in step S225. The flow then returns to the stand-by state (FIG. 20).

When the print mode is set, operations from step S226 are performed. When the communication result report print mode is set in step S227, the communication result print command is sent to the FAX main body in step S229, provided that the MBUSY signal goes to logic "0" in step S228. When an ACK signal is received in step S230, the communication result stored in the SRAM 24 is sent out as serial data to the FAX main body in step S231. If any ACK signal is received, the flow returns to step S229, and the above operations are repeated. In this case, the command is repeatedly sent a maximum of three times. After the communication result data is sent out, the external device waits for a response from the FAX main body for three seconds. If no response is sent back, processing is ended with an error. However, if a response is sent back from the FAX main body, the flow advances to step S233. If this response is an ACK signal, the flow returns to the stand-by state (FIG. 20). In this case, the data is repeatedly sent a maximum of three times in step S231.

When the registration data print mode is set (FIG. 30), the same operations as in the communication result print mode are performed. In this case, the data sent out in step S238 are various data registered in the registration mode and are sent as serial data to the main body.

The detailed operations in the function modes have been described.

The connection check operation in step S116 (FIG. 20) will be described with reference to FIG. 31. This operation is repeated every time the stand-by state is set in the flow charts in FIGS. 20 to 28, so that connection between the main body and the external device is always monitored. When disconnection of the main body from the external device is determined, the current mode is set to the automatic answer/record mode 2.

A timer for measuring the time required for waiting the response in the main body is reset and started in step S241. A request command is sent out to obtain a response from the main body in step S242, and the external device waits for the response from the main body in step S243 while the timeout of the timer is kept monitored in step S244. If the response is received before the timeout of the timer, the state of the flag FAXONF representing the connection of the main body is checked in step S245. If this flag is set at logic "1", the previous state is not changed, and the connection check operation is ended. However, if the flag is set at logic "0" in represents that, the main body is newly connected to the external device. In step S246, the flag FAXONF is set at logic "1" to release the automatic answer/record mode 2. The current mode is then set to the latest mode (i.e., the mode before the main body is disconnected). The latest mode is stored in the RAM 23 or the non-volatile RAM 24. When the timeout of the timer is detected in step S244, the flag FAXONF is checked in step S247. If this flag is set at logic "0", the previous mode is kept unchanged, and the connection check operation is ended. However, if the flag is set at logic "1", it is determined that the main body is disconnected from the external device. The flag is set at logic "0" in step S248, and the current mode is stored in the RAM 23 or the non-volatile RAM 24. The current mode is then changed to the automatic answer/record phone mode 2.

The operations of the external device have been described. In addition, when the external device has a scanner function of reading an image and a video input terminal function, the overall system can be made more convenient.

[Second Embodiment]

Unlike the first embodiment, the second embodiment exemplifies a facsimile system to be connected to an external device having no CPU. In this arrangement, when the external device is singly used, a subscriber line is connected to an external telephone set.

The arrangement of the main body is substantially the same as that of the first embodiment, except for the arrangement of contacts. The contacts will be described later.

FIG. 32 is a block diagram showing the arrangement of the external device. The blocks having the same functions as in the first embodiment will not be described below.

Using 2-to-4 wire conversion or a CML relay controlled by a CPU 11, a second NCU 211 connects a subscriber line 212 to a modem 18 or an external telephone set. The second NCU 211 is different from that of the first embodiment in that the second NCU 211 does not include an off-hook detector for the external telephone set, a CI detector, an FC detector, and a CNG detector.

An off-hook detector 218 detects an off-hook state of the external telephone set. When the CML relay of the second NCU 211 connects the subscriber line to the modem, a quasi DC loop is formed with the external telephone set, thereby detecting a current. In this case, an H relay is arranged to switch between the quasi DC loop and the subscriber line and is controlled in accordance with an HRD control signal (FIG. 33) from the CPU 11.

A CI detector 219 performs primary/secondary separation of a call signal (CI signal) input from the subscriber line 212 by using a photocoupler. Only an AC signal component is passed and detected by the CI detector 219.

A CNG detector 220 performs primary/secondary separation of a CNG control signal defined by the protocol T-30 in FAX communication by means of an audio transformer when the subscriber line is connected to the external telephone set by the CML relay. Only an AC signal component is passed and detected by the CNG detector 220.

An FC detector 221 causes a PLL circuit and the like to detect an FC signal in a non-ringing incoming call signal.

An OGM (OutGoing Message) generator 26 sends out a preregistered message upon reception of an incoming call in accordance with a control signal output from a contact (OGM) of contacts (external) 214.

A second sensor unit 210 is constituted by a recording paper end detection sensor. In the second sensor unit 210, a reflection sensor is arranged and detects the black band of the recording paper so as to detect the state of the recording paper under the control of the CPU 11.

A power source 213 is constituted by an AC adapter for converting an AC voltage into a DC voltage of +12 V, as will be described in FIG. 34, and applies the DC voltage of +12 V to the respective components of the external device.

A second console unit 28 is constituted by a mode key for designating a reception mode. The CPU 11 detects a key depression state and controls the respective components in accordance with the detected key depression state.

A speaker **216** is constituted by a speaker and a speaker driver and issues a warning tone under the control of the CPU in the main body. The speaker **216** also issues a warning tone under the control of the NCU. A transmission line can also be monitored through the second NCU **211**.

FIG. **37** shows a state in which a facsimile main body **41** is connected to an external device **42**, as indicated by the stationary state **43** in FIG. **4**B. In this state, the voltage of +12 V is applied from the external device **42** to the facsimile main body **41** through the +12 V terminal. The voltage of +12 V is regulated into a voltage of +5 V by the facsimile main body **41**. The voltage of +5 V is applied to both the facsimile main body **41** and the external device **42**.

The GND (+12 V) and GND (+5 V) terminals are common to the facsimile main body **41** and the external device **42**.

A transmission signal TX is input from a modem **18** of the facsimile main body **41** to the second NCU **211** of the external device **42** through the TX terminal.

A reception signal RX is input from the second NCU **211** of the external device **42** to the modem **18** of the facsimile main body **41** through the RX terminal.

A CML (Connect Modem to Line) signal is a signal for switching the line to the telephone set or the facsimile apparatus. The CML signal is input from the CPU **11** of the facsimile main body **41** to the second NCU **211** of the external device **42** through the CML terminal.

An HRD (Hook Relay Drive) signal is a signal for detecting the off-hook state of the telephone set and is input from the CPU **11** of the facsimile main body **41** to the second NCU **211** of the external device **42** through the HRD terminal.

A CNG (calling tone) signal is input from the CNG detector **220** of the external device **42** to the CPU **11** of the facsimile main body **41** through the CNG terminal.

An outgoing message OGM is input from the CPU **11** of the facsimile main body **41** to the OGM generator **26** of the external device **42** through the OGM terminal.

A CI signal is a call signal which is input from the CI detector **219** of the external device **42** to the CPU **11** of the facsimile main body **41** through the CI terminal.

An FC signal is a facsimile call signal which is input from the FC detector **221** of the external device **42** to the CPU **11** of the facsimile main body **41** through the FC terminal.

An OFHK signal is an off-hook detection signal which is input from the off-hook detector **218** of the external device **42** to the CPU **11** of the facsimile main body **41** through the OFHK terminal.

An RPS signal is a recording paper sensor signal which is input from the second sensor unit **210** of the external device **42** to the CPU **11** of the facsimile main body **41** through the RPS terminal.

A BAT/AC signal is a control signal for determining whether a battery, an AC power source, or a car battery is used. The BAT/AC signal is input to the CPU **11** of the facsimile main body **41** through the BAT/AC terminal.

A DSK/PRT signal is a control signal for determining whether a stationary or portable state is set. The DSK/PRT signal is input from the external device **42** to the CPU **11** of the facsimile main body **41** through the DSK/PRT terminal.

An SPCNT signal is a speaker control signal which is input from the CPU **11** of the facsimile main body **41** to the speaker **216** of the external device **42** through the SPCNT terminal.

Operations of the second embodiment different from those of the first embodiment will be described below. In the second embodiment, the operations from the flow B in FIG. **8** of the first embodiment are changed. The flow B in FIG. **7** advances to a flow B in FIG. **35**.

It is determined in step **S249** whether the FC signal having the frequency of 1,300 Hz is detected. If YES in step **S249**, the receive or reception mode is set in step **S250**. If NO in step **S249**, it is determined in step **S251** whether the mode switch sets the manual mode. If YES in step **S251**, a tone or pulse signal sent from the telephone set to the facsimile apparatus to switch the mode is detected in step **S252** or **S253**. In this case, the tone signal is detected by a modem in the main body through the RX contact of the contacts, and the pulse signal is detected by the CPU in the main body through an OFHK (off-hook signal) contact of the contacts. When neither signals are detected, the flow returns to the stand-by state (FIG. **7**). When either signal is detected, the CML relay is switched to the facsimile side, and the reception mode is set in step **S250**.

If NO in step **S251**, it is determined in step **S254** whether the mode switch sets the FAX/TEL auto change mode. If YES in step **S254**, it is determined in step **255** whether the CI signal is detected. If NO in step **S255**, the flow returns to the stand-by mode (FIG. **7**). However, if YES in step **S255**, a reply message **1** (Calling now. Please wait.) is sent out in step **S256**. It is determined in step **S257** whether the BT (Busy Tone) signal is detected by the modem in the main body. If YES in step **S257**, the line is released in step **S258**, and the flow returns to the stand-by state (FIG. **7**). However, if NO in step **S257**, it is determined in step **S259** or **S260** whether the FC signal is detected or the CNG signal having the frequency of 1,100 Hz is detected. If either signal is detected, the reception mode is set in step **S250**. However, if neither signals are detected, a buzzer tone is issued in step **S261** to inform that the other end of the line is a telephone set. Thereafter, it is determined in step **S262** whether the handset is picked up, i.e,. the off-hook signal is detected. If YES in step **S262**, the buzzer tone is stopped in step **S263**. The line is switched to the external telephone set in step **S264**, and the flow returns to the stand-by mode (FIG. **7**). However, if NO in step **S262**, the buzzer tone is stopped in step **S265**, and a reply message **2** (No answer. Please send a facsimile.) is sent out in step **S266**. The reception mode is then set in step **S250**.

If the FAX/TEL auto change mode is not set in step **S254**, it is determined in step **S267** whether the mode switch sets the automatic answer/record telephone connection mode. If NO in step **S267**, the flow returns to the stand-by mode (FIG. **7**). However, if YES in step **S267**, it is determined in step **S268** whether the CNG signal is detected. If YES in step **S268**, the reception mode is set in step **S250**. However, if NO in step **S268**, it is determined in step **S269** whether any tone is detected. If NO in step **S269**, the reception mode is set in step **S250**. Otherwise, the stand-by state (FIG. **7**) is set.

A copy operation will be described in detail with reference to a flow chart in FIG. **36**.

When a copy mode is set, it is determined in step **S270** whether the BAT/AC signal from the corresponding contact is set at logic "0". The BAT/AC signal is a signal for determining whether the power source is an AC power source, a battery, or a car battery, and this signal has been described in detail in FIG. **18**. If the signal BAT/AC=0 in step **S270**, then a full print mode is set in step **S271**. However, if the signal BAT/AC=1 in step **S270**, then it is determined in step **S272** whether an economy mode is set. If YES in step **S272**, a thin print mode for performing a thin print operation is set in step **S273**. However, if NO in step **S272**, a mode for thinning the data only when the black rate in one read line of the original sheet is 50% or more is set.

Any one of the modes is set in step S271, S273, or S274, and the copy operation is performed in step S275. The flow then returns to the stand-by state.

The thin print mode and the mode set when the black rate is 50% or more are energy-saving modes in use of a power source except for the AC power source. This also applies to facsimile message printing during reception.

In this embodiment, the off-hook detector **218** for detecting the off-hook state of the telephone set or the like connected to the subscriber line **212** detects a current by forming a quasi DC loop with the telephone set connected to the subscriber line **212** by the CML relay of the second NCU **211** when the subscriber line is connected to the modem. However, the off-hook state may be detected by comparing the detected voltage with a threshold level.

Alternatively, the CI detector **219**, the CNG detector **220**, and the FC detector **221** may comprise Hall elements for performing primary/secondary separation of the corresponding signals to extract only the corresponding AC components.

The discharge characteristics of the battery and remaining amount warning of the battery will be described below.

FIG. **39**A is a graph showing the discharge voltage characteristics when a battery discharge current, i.e., current consumed by the apparatus is constant. In the initial period, the battery has almost a rated value. However, the voltage is decreased with a lapse of time, and finally the voltage level is abruptly decreased.

In consideration of the above discharge voltage characteristics, a small remaining amount of the battery is warned to the user by a voltage setting circuit in a voltage monitor **133**.

FIG. **39**B is a graph showing discharge voltage characteristics when a battery discharge current is changed.

The current consumed by the facsimile apparatus varies depending on states, i.e., the stand-by state, the transmission state, the reception state, and the copy state as well as the type of original sheet. As shown in FIG. **39**B, even if the remaining amount of he battery is sufficient, if a heavy load is imposed, the battery voltage is decreased. If the decreased voltage is lower than a warning voltage set in the voltage setting circuit in the voltage monitor **133**, an LED **134** flashes ON and OFF. The battery voltage is increased again because of the sufficient remaining amount of the battery, and the LED **134** stops flashing and is kept on.

When the detected voltage is lower than the warning voltage in continuous normal use of the battery, the LED **134** flashes ON and OFF again. At this moment, since the remaining amount of the battery is small, the battery voltage is not increased, and the LED **134** is kept flashing, thereby giving a warning to the user.

The low battery level can be informed to the user, and a countermeasure can be taken by the user such that the battery is charged.

In the first embodiment, the low battery level can be informed by flashing of the LED **134**. However, a buzzer tone may be issued in place of use of the LED **134**. In the arrangement shown in FIG. **1**, a buzzer **131** can be driven in accordance with an output signal from the voltage monitor **133**. In this case, the LED **134** can be omitted from the arrangement of the main body.

FIGS. **40**A and **40**B are graphs showing the discharge characteristics of a battery and operation for warning the remaining amounts of the battery. The operations in FIGS. **40**A and **40**B are the same as those in FIGS. **39**A and **39**B except that the buzzer is operated in place of flashing of the LED **134**.

In this embodiment, the LED **134** is used for warning the remaining amount of the battery. However, the LED **134** may also be used as a power indication LED for indicating the power-ON state.

FIGS. **41**A and **41**B are graphs for explaining the discharge characteristics of the battery, warning of the remaining amount of the battery, and power indication.

FIG. **41**A shows the discharge voltage characteristics when the discharge current of the battery is constant. As in the above embodiment, the battery voltage is kept at the rated voltage in the initial period. However, the voltage is gradually decreased with a lapse of time, and finally the voltage level is abruptly decreased.

In consideration of these discharge voltage characteristics, the voltage level for changing power indication as the continuous ON state of the LED **134** to the low battery level as flashing of the LED **134** is set by a voltage setting circuit in a voltage monitor **133**.

FIG. **41**B is a graph showing the discharge voltage characteristics and the LED drive waveform of the voltage monitor **133** which monitors the discharge voltage characteristics when the discharge current of the battery is changed.

When the battery voltage is sufficiently high in the normal application state, the continuous ON state of the LED **134** is kept by the voltage monitor **133**. When a heavy load is temporarily imposed to decrease the battery voltage, and the detected voltage is lower than the warning voltage set by the voltage setting circuit, the LED **134** flashes ON and OFF. In this case, since the battery capacity is sufficient, the battery voltage is increased again, and the LED **134** stops flashing ON and OFF and is kept on.

When the detected voltage is lower than the warning voltage in continuous normal use of the battery, the LED **134** flashes ON and OFF again. At this moment, since the remaining amount of the battery is small, the battery voltage is not increased, and the LED **134** is kept flashing, thereby giving a warning to the user.

The state of the LED **134** is apparent from the LED drive output indicated in the lower part of FIG. **41**B. That is, when the detected voltage is the warning voltage or more, the LED drive output is kept at "1" to keep the LED **134** on. However, when the detected voltage is lower than the warning voltage, the level of the LED drive output is repeatedly changed between "0" and "1", thereby flashing the LED **134**.

As described above, the battery remaining amount warning LED and the power indication LED are constituted by a single LED to reduce the parts in the main body, thereby reducing the cost and size of the main body.

According to the present invention, the portable image communication apparatus using the battery includes a means for warning a decrease in battery voltage. A system resetting function for resetting the system upon a voltage variation need not be provided, and a proper operation can be suitably performed for the low battery level, thereby eliminating an unnecessary resetting operation and obtaining an optimal operation.

The above description is concerned about the differences from the first embodiment and about the second embodiment having no CPU in the external device.

As described above, a single facsimile apparatus wherein the external device and the main body can be separated from each other can be selectively used as a portable facsimile apparatus or a desktop personal facsimile apparatus.

The main body used as the portable facsimile apparatus has minimum functions such as transmission, reception, and copying required for portable use and is thus compact and lightweight.

When the main body is connected to the external device, other various functions are added, and the integral unit can be used as a stationary facsimile apparatus. The additional functions are an automatic receive function, an automatic answer/record phone function, an external telephone set/automatic answer/record phone terminal function, an F network non-ringing incoming call function, an automatic outgoing call function, a display (e.g., an LCD) function, and a speaker function. Of these functions, necessary functions are selected in accordance with the application environment of the facsimile apparatus, thereby providing an apparatus having cost equivalent to the functions. Data required for controlling the external device and data for using the functions of the external device are stored in the external device, so that the memory capacity of the main body can be minimized.

When the main body is disconnected from the external device, the external device can be operated singly to serve as an automatic answer/record phone. In addition, the input facsimile data may be stored in the form of analog signals. When the main body is connected to the external device, the analog data are synthesized through a modem, thereby extracting the composite image as a facsimile image.

The roll of paper is stored in the external device, and cut sheets are used in the portable use, thereby providing a lightweight portable apparatus.

[Third Embodiment]

The third embodiment exemplifies a stationary facsimile apparatus in which a recording apparatus of the present invention is arranged.

FIG. **42** is a block diagram showing a facsimile apparatus according to the third embodiment of the present invention. This facsimile apparatus can selectively use an AC adapter or a battery in accordance with a key input by an operator. The record mode is changed in accordance with the type of power source. The respective components of this embodiment will be sequentially described below.

A CPU **61** controls the overall operation of the apparatus in accordance with programs stored in a ROM **62**. More specifically, the CPU **61** controls a RAM **63**, a non-volatile RAM **64**, a character generator (CG) **65**, a recorder **66**, a reader **67**, a modem **68**, a network control unit (NCU) **69**, a console unit **72**, a display **73**, and a select signal sender **74**.

The RAM **63** is used as a work area of the CPU **61** and has an image memory area for storing binary image data read by the reader **67** and externally input binary image data. The non-volatile RAM **64** stores data to be saved even if the main power switch is turned off. The CG **65** comprises a ROM for storing characters constituted by JIS or ASCII codes.

The recorder **66** includes a thermal recording head and a recording paper convey system and records a received image or an image during copying of an original sheet. The reader **67** includes a CCD line sensor and an original sheet convey system and reads an image of an original sheet.

The modem **68** performs modulation or demodulation of communication image data and the like. The NCU **69** selectively connects a telephone line **70** to the modem **68** or a telephone set **71**.

The console unit **72** has a ten-key pad **81**, a start key **82**, a stop key **83**, a copy key **84**, a resolution (fine/normal) key **85**, and an auto/manual key **86** and inputs various data. In particular, in this embodiment, the console unit **72** includes a select (AC/BAT) key **87** for selecting an AC adapter power source or a battery as a power source.

The display **73** includes an LCD and displays the current time and operating states. The select signal sender **74** sends out a select signal such as a pulse dialer or a tone dialer through the NCU **69**.

FIG. **44** is a flow chart showing a recording operation in the receive or reception mode of the third embodiment.

Up to reception of an image signal in step **S1060**, the known facsimile reception procedures are used. In image reception, the CPU **61** refers to the state of the select (AC/BAT) key **87** (**S1061**). When the AC adapter power source is used, recording is performed in accordance with a printing scheme of the normal mode (**S1062**). In this embodiment, the normal mode is defined as a mode in which all lines are printed, data of each line is decoded to obtain raw data, and the raw data is sent to the recorder **66**, thereby printing the data on the recording paper.

In step **S1061**, when the battery is used, recording is performed in accordance with a printing scheme for performing a thin print operation in accordance with a black rate as the record mode for battery (**S1064**). That is, the record mode for battery is the thin print operation for lines each having a black rate of 50% or more.

The recording operation is repeated while checking the recording scheme every line. When an RTC is received and recording of the entire input image is completed (**S1063**), the print operation is completed (**S1065**), and the known post procedures are performed.

FIG. **45** is a flow chart showing the record mode for battery in step **S1064**.

The record mode for battery is confirmed (**S1070**), and one line is decoded. The decoded raw data is stored in a decoding buffer (**S1071**). A black rate is calculated (**S1072**). For this purpose, a sum of black run-length data is calculated. For example, if the sum is less than 1,024 bits of the one-line data length, i.e., 2,048 bits for the B4 size, the black rate is determined to be less than 50%. The raw data in the decoding buffer is transferred to a record buffer, and printing is performed (**S1074**).

If the sum of the black run-length data is 1,025 bits or more, the black rate is determined to be 50% or more. It is determined in step **S1075** whether this line is an odd or even line. If this line is determined to be the odd line, all even dots are made into white data, and the white data are transferred to the record buffer (**S1077**). Printing is then performed (**S1074**).

As described above, the peak current during printing can be almost halved in use of the battery. The service life of the battery can be prolonged.

The third embodiment exemplifies receive mode processing but can also be applied to a copy operation. In the third embodiment, data is thinned bit by bit in accordance with the black rate of 50% or more in use of the battery. However, one bit every four bits may be thinned at the black rate of 25% or more.

The present invention is not limited to the facsimile apparatuses described above, but is applicable to a variety of devices using an AC adapter power source and a battery or car battery.

According to the present invention, different printing schemes are used in use of the AC adapter power source and in use of the battery, respectively. Therefore, high-quality printing by the AC adapter power source can be assured while the power consumption of the battery can be kept low.

The present invention has been described with reference to the preferred embodiments. However, the present invention is not limited to these particular embodiments, and various changes and modifications may be made within the scope of the appended claims.

What is claimed is:

1. A method for externally controlling a facsimile apparatus by conducting mutual communication between the facsimile apparatus and a programmable apparatus, the method comprising the steps of:

receiving, at the programmable apparatus, a communication result receive command from the facsimile apparatus;

further receiving, at the programmable apparatus, a communication result from the facsimile apparatus after having sent an acknowledgment of the communication result receive command to the facsimile apparatus; and

notifying the facsimile apparatus of a status of the communication result received in the further receiving step either by sending an ACK signal or a NAK signal to the facsimile apparatus.

2. A programmable apparatus, operable in accordance with a stored program comprising code for performing a method for externally controlling a facsimile apparatus by conducting mutual communication with the facsimile apparatus, said method comprising the steps of:

receiving a communication result receive command from the facsimile apparatus;

further receiving a communication result from the facsimile apparatus after having sent an acknowledgment of the communication result receive command to the facsimile apparatus; and

notifying the facsimile apparatus of a status of the communication result received in the further receiving step either by sending an ACK signal or a NAK signal to the facsimile apparatus.

3. A memory storing a program comprising code for performing a method for externally controlling a facsimile apparatus by conducting mutual communication between the facsimile apparatus and a programmable apparatus, said method comprising the steps of:

receiving, at the programmable apparatus, a communication result receive command from the facsimile apparatus;

further receiving, at the programmable apparatus, a communication result from the facsimile apparatus after having sent an acknowledgment of the communication result receive command to the facsimile apparatus; and

notifying the facsimile apparatus of a status of the communication result received in the further receiving step either by sending an ACK signal or a NAK signal to the facsimile apparatus.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,476,939 B1
DATED : November 5, 2002
INVENTOR(S) : Hisashi Toyoda et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [56], FOREIGN PATENT DOCUMENTS,"63046530" should read -- 63-046530 --; "2036971" should read -- 2-36971 --; and "3218163" should read -- 3-218163 --.

Drawings,
SHEET 35, FIG. 38A, "THIS ARE" should read -- THIS IS --.

Column 2,
Line 20, "embodiment;" should read -- first embodiment; --.

Column 9,
Line 48, "EOLS)," should read -- EOLs), --; and
Line 51, "step 69." should read -- step S69. --.

Column 14,
Line 57, "form" should read -- from --.

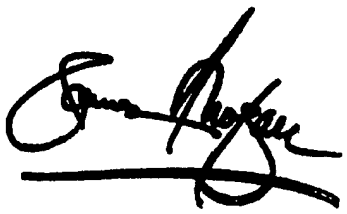
Column 15,
Line 58, "in" should read -- it --.

Column 18,
Line 19, "step 255" should read -- step S255. --.

Column 19,
Line 39, "he" should read -- the --.

Signed and Sealed this

Twenty-first Day of October, 2003



JAMES E. ROGAN
Director of the United States Patent and Trademark Office